OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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"RAILWAY PURCHASING".

By C. D. YOUNG, Assistant Vice President, Purchases, Stores and Insurance, Pennsylvania Railroad Company, Philadelphia, Pa.

OFFICIAL PROCEEDINGS

OF

The Railway Club of Pittsburgh

Organized October 18, 1901

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F. H. STARK........November, 1905, to October, 1907
*H. W. WATTS........November, 1907, to April, 1908
*D. J. REDDING........November, 1908, to October, 1910
*F. R. McFEATTERS........November, 1910, to October, 1912
†A. G. MITCHELL........November, 1912, to October, 1914
*F. M. McNULTY........November, 1914, to October, 1916
J. G. CODE........November, 1916, to October, 1917
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*J. A. SPIELMANN........November, 1918, to October, 1919
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G. W. WILDIN........November, 1926, to October, 1927
E. J. DEVANS........November, 1927, to October, 1928
W. S. McABEE........November, 1928, to October, 1929
E. W. SMITH........November, 1929, to October, 1930

*—Deceased.
†—Resigned.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
NOVEMBER 25, 1930

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Allison, John
Altsman, W. H.
Anderson, G. S.
Askin, J. A.
Baker, J. B.
Batchelar, E. C.
Beck, C. H.
Blair, John R.
Boylan, P. F.
Brinkhoff, W. H.
Bruce, S. S.
Buffington, W. P.
Burgham, M. L.
Carson, John
Carter, William
Cassiday, David A.
Chilcoat, H. E.
Clark, C. C.
Conway, J. D.
Cotter, G. L.
Crawford, A. B.
Crawford, D. F.
Crenner, Joseph A.
Croke, Thomas F.
Cunningham, R. I.
Darrall, William G.
Davis, Charles S.
Diven, J. B.
Dobson, F. L.
Dunbar, Harold F.
Durkin, James E.
Eagan, D. F.
Edwards, C. H.
Emery, E.
Emsheimer, Louis
Endsley, Prof. Louis E.
Flinn, R. H.
Frauenheim, A. M.
Freshwater, F. H.
Gammiere, E. J.
Geisler, Joseph J.
Gilg, Henry F.
Glaser, J. P.
Gorman, Charles
Hancock, Milton L.
Hansen, William C.
Hickling, F. G.
Hilstrom, A. V.
Holmes, E. H.
Hood, J. M.
Hoover, J. W.
Howard, L. F.
Hughes, John E.
Jungbluth, Adolph
Kelly, L. J.
Kroske, J. F.
Kummer, Joseph H.
Lackner, R. A.
Lanahan, Frank J.
Laurent, Joseph A.
Leach, W. A.
Leban, J. L.
Lobez, P. L.
Loeffler, George O.
Longdon, Clyde V.
Lowman, John R.
Lunden, C. J.
Lynch, B. J.
Mantell, W. T.
Meyers, W. H.
Miller, John
Mills, C. C.
Misner, George W.
Morgan, A. L.
Moyer, Oscar G.
Muir, R. Y.
Myers, W. H.
McCoy, James M.
McGeorge, D. W.
McIntyre, R. C.

McKedy, H. V.
McKinley, A. J.
McNamee, W.
McNelty, A. P.
Nash, R. L.
O'Connor, M. J.
Paisley, F. R.
Passmore, H. E.
Perkins, Charles F.
Posteraro, S. F.
Pringle, P. V.
Provost, S. W.
Rauschart, E. A.
Reifsnyder, J. W.
Reynolds, D. E.
Rizzo, C. M.
Rushneck, G. L.
Ryan, D. W.
Rys, C. F. W.
Saltic, Thomas
Sample, W. E.
Sattley, E. C.
Schaffer, W. E.
Schubert, C. F.
Schuchman, W. R.
Schultz, D. C.
Seiss, W. C.
Seroky, Edward A.
Severn, A. B.
Van Wormer, G. M.
Watt, Herbert J.
Weaver, W. Frank
Wheatley, William A.
Wheeler, C. M.
Wikander, O. R.
Woodward, Robert
Wright, Edward W.
Wurts, T. C.
Zammikiel, John
Sutherland, Lloyd
Sykes, A. H.
Thomas, Theodore
Tomasic, N. M., Jr.
Toussaint, R.
Trautman, Harry J.
Uline, C. S.
Unger, Dr. J. S.
Van Blarcom, W. C.
Vandivort, R. E.
Shannon, David E.
Sheets, H. E.
Shellenbarger, H. M.
Showalter, Joseph
Simons, Philip
Smith, H. L.
Smyth, R. W.
Stevens, L. V.
Stillwagon, C. K.

VISITORS

Bartlow, H. P.
Bell, Frank
Berk, Robert J.
Berger, Bernard
Bitzel, H. J.
Carruthers, G. R.
Church, S. L.
Coleman, N. E.
Burleigh, C. T.
Butler, R. E.
Fisher, I. D.
Forrester, J. B.
Froebel, G. H.
Fry, L. H.
Gable, M. G.
Goodwin, R. E.
Hemma, Charles H.
Jolly, T. D.
Keck, Karl G.
Kelly, John E.
King, William R.
Kinsey, A. G.
Kuzma, Paul
Latshaw, T. R.
Leech, George R.
Lewis, S. B.
Lindauer, August
Longstreth, W. L.
Marx, Frank J.
Meider, Howard W.
Meyers, William B.
Mock, J. C.
Monroe, E. T.
Mosier, O. H.
Mayer, Louis H.
McGinness, George H.
McWilliams, J. B.
Nicodemus, E. H.

Orleman, Edward H.
Penz, O. F.
Peterson, L. H.
Prendergast, M. A.
Robertson, E. C.
Robertson, M. R.
Rutherford, James H.
Sage, Ralph V.
Schmitt, G. A.
Smith, Sion B.
Toussaint, R., Jr.
Wiggins, W. D.
Young, C. D.

The calling of the roll was dispensed with as the registry cards furnish a record of attendance.

By common consent the reading of the minutes was dispensed with as they are now in the hands of the printer.

The Secretary read the following list of applications for membership:

Butler, R. E., Vice President, Rust Engineering Company, Koppers Building, Pittsburgh, Pa. Recommended by F. H. Freshwater.

Fields, S. H., Vice President, American Tar Products Company, Koppers Building, Pittsburgh, Pa. Recommended by F. H. Freshwater.

Fry, Lawford H., Railway Engineer, Edgewater Steel Company, P. O. Box 249, Pittsburgh, Pa. Recommended by D. W. McGeorge.

Kittle, Ralph M., Salesman, Ingersoll-Rand Company, 1616 McFarland Road, Dormont, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Lortz, Elmer A., Safety Engineer, Pressed Steel Car Company, 3924 Winshire Street, N. S., Pittsburgh, Pa. Recommended by G. M. Van Wormer.

Stephenson, G. C., American Tar Products Company, Koppers Building, Pittsburgh, Pa. Recommended by F. H. Freshwater.

Schultz, D. C., 253 Beverly Road, Mt. Lebanon, Pittsburgh, Pa. Recommended by J. D. Conway.

Wark, J. M., Assistant General Foreman, Passenger Car Inspection, Pennsylvania Railroad, 7418 Penfield Court, Pittsburgh, Pa. Recommended by Harry W. Lehr.

Wiggins, W. D., Chief Engineer, Pennsylvania Railroad, 1135 Pennsylvania Station, Pittsburgh, Pa. Recommended by F. H. Freshwater.

Young, C. D., Assistant Vice President, Purchases, Stores and Insurance, Pennsylvania Railroad, Broad Street Station Building, Philadelphia, Pa. Recommended by D. F. Crawford.

PRESIDENT: In accordance with our By-Laws these applications will be referred to the Executive Committee, and upon approval by them the gentlemen become members without further action by the Club.

Is there any further business to be taken up at this time? If not, we come to the address of the evening. I am going to digress just a moment to say that thirty years ago next Fourth of June Charlie Young and I were in the same track meet in Buffalo at the Pan-American Exposition. That was the first time I ever met him. It gives me very great pleasure to introduce to you Mr. Charles D. Young, who has agreed to come here and give us a talk on "Railroad Purchasing." Mr. Young is Assistant Vice President in charge of Purchases, Stores and Insurance, Pennsylvania Railroad. Mr. Young.

"RAILWAY PURCHASING"

By C. D. YOUNG,

Assistant Vice President, Purchases, Stores and Insurance, Pennsylvania Railroad Company, Philadelphia, Pa.

Last Spring, when your President, Mr. E. W. Smith, asked me to come to Pittsburgh to address your Club on the subject of "Railway Purchasing," I hesitated at first to undertake the task, but knowing it would bring me to Pittsburgh, and would be the means of seeing a lot of my old friends, and afford me the pleasure of talking to all of them at one time, I accepted his very kind invitation; and I am honored that Mr. C. O. Dambach, the Chairman of your Subject Committee, has extended me the privilege of being with and addressing you this evening on a subject with which I have been intimately connected only a relatively short time in my railroad career.

To me, coming back to Pittsburgh is a good deal like coming home. Many of you know I was located here when the Pennsylvania Railroad consisted of the former Lines East and West of Pittsburgh. I was a part of the Lines West organization. Since that time I have been here rather frequently, carrying out my railroad duties. This is but natural, as the heart of the operation of the Pennsylvania Railroad is in this

territory, with Pittsburgh as its center; so that when you actually want to find out how things should be done, or are being done, you come to Pittsburgh—the center of progress and activity in the manufacture of railway materials.

My talk tonight will be a bit rambling, and purposely so, for the reason that I want to give you men actually on the firing line the essential points as I see them that make railway purchasing and storekeeping a real live human problem and one of keen interest to those who are actually carrying out in the field, the plans and directions of the headquarters officers of the railroad who are charged with the responsibility of this important function of the railroad.

That buying is an important function is best reflected by some figures I have just received, being a compilation of 40 railroads, operating 108,000 miles of line and representing 48 per cent of the railway purchasing power, which shows, excluding equipment purchases, that for the first nine months of 1929 these 40 roads purchased 531 million dollars worth of materials compared with 451 millions for the same nine months of 1930, and representing a decrease of 15 per cent this year compared with last year. The buying power, therefore, of all the railroads, if equipment were included in the year 1930, would probably reach considerably more than a billion dollars.

In order not to lull you to sleep with statistical information, I will not separate the commodities making up this vast sum of money. All of you are aware that in buying for a railroad practically every commodity in industry is involved, and it is becoming more complicated as transportation expands into means other than by rail.

It seems appropriate to point out that the trend of the larger purchases is in the direction of metals rather than forest products, and as an old railroad saying goes—years ago we used to have wooden cars and iron men; now we have iron cars and wooden men. So it is with purchasing. In carrying the similie a little further, I believe the selling fraternity will subscribe to the possible thought—particularly after they have lost an order which they feel should be theirs—that most of the wooden men have been localized in purchasing departments.

Historically, the Purchasing and Stores Departments of the Pennsylvania Railroad were created to centralize in the hands of responsible officers the entire duties of requisitioning, buying and distributing materials required for use on the railroad and for serving the traveling public. The history of the buying

section of the Pennsylvania Railroad is a long one, that department having been created some fifty odd years ago.

The early inception of the department was apparently for the purpose of relieving the operating officers of the time occupied in negotiating for purchases of needed materials. Now the department is not only for that purpose, but for many others, such as creating markets, stimulating industries local to the line of the railroad, and assisting, wherever practicable, in establishing friendly relations between the public and the railroad, to the end that the industries on the line of our railroad may be prosperous.

In the early days of the railroad the requisitioning of materials was not given the attention it has received during the last ten years; but with the deflation in industry, required following the war period, there was need for strong control in the requisitioning of material so that the inventory would be kept as low as practicable, and for this reason the Stores Department was organized, to exercise that control.

The experience of the speaker—which covers various positions on this railroad in the Mechanical as well as in the Operating Department—has shown that the primary function of effective control will not be obtained by leaving the entire question to the users of the material. They cannot be consistent, nor at all times concerned with the total value of stocks on hand; their regular duties require too much of their attention to give the question of supply control the serious consideration necessary to efficiently operate with minimum stocks. This sketch outlines why a railroad has a service of supply, autonomous and distinct from the other functional operations of the property.

How, now, can the buyer best perform these specific duties? First, and foremost, both in purchasing and the management of stores, by the assistance and sympathetic co-operation of you men, representing the active, responsible officers who are charged with maintaining and running the railroad. Without such co-operation and understanding of the difficulties a supply department cannot be successful. It is organized for service to you men, who must keep the wheels of the railroad moving; and if there has been any success in our department the credit belongs to you.

Let me illustrate how this has been brought about: Not many years ago little actual planning was given to the work to be performed in our shops and on the tracks. All of this

has been changed the last few years. Now the work is so programmed that quantity purchases are made and material delivered by means of time spacing, and we have reached the point, particularly in our larger operations, where the users have given attention to a program and processing of work to the extent that generally the material is delivered as needed; thus it moves direct from freight car to point of actual use.

Let us see how this has assisted the manufacturer and the supply fraternity. It has reduced the number of orders the manufacturer receives and has increased the volume of the order, thus permitting the manufacturer to get out material in quantities at a time when it is most convenient for him to do so, and in many instances has afforded a backlog for his operation, allows a railroad order to be filled when his plant is slack, or set aside for the moment the railroad order when rushed for quick delivery by a less provident purchaser.

For the railroad it has resulted in their ability to guarantee to the operating department the completion of work at a specified time and has assisted the shops and enginehouses to so well carry out their programs on scheduled deliveries that the operating officer does not now need to concern himself about materials to the extent he did formerly.

Another phase is the assistance the Engineering Department has rendered in successful storekeeping by the progress made in railway standards. Through the American Railway Association's engineering activities, designs and specifications have been created, making it possible to purchase material with which the manufacturers are currently and thoroughly familiar; and in many instances are prepared through the general use of the designs and specifications to furnish material practically on demand. This standardization has simplified the stock problems at the storehouses; reduced the number of items necessary for continuity of operation; reduced the number of dies and patterns necessary, and at the same time has afforded a better quality of material for railroad use. So you can see that through the local activities of the several departments on the railroad the problem of purchasing and storekeeping has been gradually simplified and greatly improved.

As some of you are railroad officers and others are supply officers, I think it would be well to touch upon the aims and desires of the buyers in their relationship to industry. It is assumed that the salesman recognizes some of the problems of buying. Frequently he may be dissatisfied with his share of

the distribution of an order. This is but natural. Often he forms the conclusion that price is the prime interest of a Purchasing Agent, and that he has less regard for service, quality and delivery. The trained buyers of the Pennsylvania Railroad probably are not free from this criticism, but a review of each case which has come to my personal attention indicates that the buyers are always alert to the question of quality, as measured either by specifications or engineering approval, and that with quality and service constantly before them they endeavor to buy at a price commensurate with the quality and service represented by the value of the merchandise. To do this they are assisted in their judgment of the actual value of the material by statistical facts, and by frequent and constant contact with the several railway departments, together with the knowledge and assistance offered by supply salesmen.

Before closing I want to say to the many salesmen who daily come in contact with members of the purchasing department that there are three cardinal principles which the buyer endeavors to uphold — FIRMNESS, FRIENDLINESS and FAIRNESS. First, he must be firm. He must give complete regard to the quality represented, and the service demanded in the material to be purchased; then having studied the market as to the price for the goods, he must be firm in his decision as to what constitutes a fair price. Second, he endeavors to be friendly. He is assisted at all times in this important attitude by the courteous treatment accorded him by the seller. As goes with human nature, all sellers are not friendly; but even when they are not, it is the duty of the buyer to maintain a friendly attitude toward the seller if he is to successfully continue negotiations with the manufacturer from month to month. Third, above all else the buyer must be fair. As in the operation of all business, so in the purchase of materials a man falls short of his responsibility as a buyer if he is not fair. If I were asked the most essential requirement of a good buyer I would say it is fairness, and I use this word in its broadest sense. Without fairness, which includes honesty, successful buying cannot be accomplished. Frequently a buyer may be mislead if he does not receive all the facts—good or bad—surrounding the materials to be purchased. Here is where the successful purchaser must weigh and pass final judgment on all the evidence before making a successful purchase. And here we find a key to successful buying. With a fair buyer and a full presentation of all the facts before him, there is little

doubt that the order will be properly placed, and if the quantity required necessitates allocation to a number of manufacturers, that the distribution will be equitable.

Perhaps this discussion has aroused some doubts or questions, and even suspicion, in the minds of you men—at least I hope so. What I have said has been for the purpose of arousing an interest in this important subject. Some of the points brought up, I believe, can best be explained by a general discussion of the subject, and rather than overexpounding my views, I would appreciate the views of some of you gentlemen on this subject so that I may take with me some thoughts for strengthening or improving the activities of stores and purchasing. It would be my desire, therefore, that with the permission of your President we have an open discussion of this subject by you men who in many ways are qualified to bring out points of mutual interest to the buyer, the seller and the user of materials.

PRESIDENT: I am sure there are men here tonight who want to ask some questions or state what they think of the subject. Let us have volunteers. If not, I will call on you, you may be certain of that. Mr. Reynolds, of the Bessemer & Lake Erie, may we hear from you?

MR. D. E. REYNOLDS: I do not know that I can add anything to what Mr. Young has said. We are always trying to be a department of service to the operating departments, and also an intermediary between the railroad and the commercial world. Our point of contact sometimes—indeed at all times—is a little delicate. Mr. Young has said nobody is satisfied and probably never will be. We endeavor to keep our operating departments satisfied first. We try to keep our costs in line with values and everything at a satisfactory level. Price is important, but I think the first thing is the matter of values rather than price. This is the basic principle of modern plant economy. Practically everything used by the railroad, and the railroad uses practically everything you can think of, is handled through the purchasing department, rolling stock, roadway and building materials, but notwithstanding all these subjects on our shoulders from time to time, we endeavor to carry on without a failure.

PRESIDENT: Mr. Crawford have you anything to say?

MR. D. F. CRAWFORD: I do not know why you call on me to say anything.

PRESIDENT: You are in the front row.

MR. CRAWFORD: As to purchasing and selling, I do not do either, and I have not done either for several years. Mr. Young of course has pointed out very clearly the requirements of a purchasing agent and a purchasing department. There is no question as to the heavy responsibility that is put on the purchasing department of any railroad by the very very many articles they are required to consider. I have some recollection of the many problems that were brought before me when I was active in railroad work and I know that in the ten years that have passed since that time many items have been added that require very careful consideration by the purchasing department, even with the most carefully prepared specifications and directions from the operating department.

It is a pleasure to me to know that Mr. Young, who started at least a part of his work with me, has succeeded so admirably in etsablishing—as I know he has established—the purchasing department of the Pennsylvania and put it on such excellent grounds, and I sympathize with him in many of the problems that I know he has to meet.

PRESIDENT: Mr. Flinn, General Superintendent, Pennsylvania, what have you to say on this subject?

MR. R. H. FLINN: I do not know why you call on me, because I do not know very much about purchasing. But I think it might be of help to some of the operating people here, and perhaps some of the others as well, to say that a few years ago when the stores department was first organized on our railroad it was with a great deal of trepidation and fear among the operating people that they would not be allowed to have any more material. As Mr. Young has very wisely said, I do not suppose you can leave the ordering of material to the user because the user has rather vague and unformed ideas as to what his needs will be and in order to protect himself he is very apt to buy very liberally, at least that has been our experience, and I am sure Mr. Young will confirm that because of his larger knowledge of the situation. But during the period when the stores department had growing pains, so to speak, in get-

ting this department organized on a proper basis, there was more or less difficulty in getting material when they wanted it. But in the last few years it is very rarely that we have any difficulty in securing material as it is needed. It has been done through a very fine control of the situation by the stores department in Philadelphia and the purchasing department, and we do not know what it is to worry about material. I suppose the other railroads and the large industrial concerns have had the same experience.

But I do want to say that because of the better material condition that we have today, with a very much lower stock of material, we are getting even better service. And that is undoubtedly a good thing for the industry generally, because if conditions demand the use of more material it is immediately reflected in the buying end of the Pennsylvania Railroad. I just want to emphasize what Mr. Young and his department are doing by the proper control of materials. It is a good deal better than it was before, when we had rather haphazard methods of securing materials.

There is one angle of purchasing that occurs to me rather frequently, and that is the great number of new devices and new materials that are put on the market for the benefit of the railroads. You recognize that we have to depend to a large extent on the ingenuity of the industry in developing new devices, and I think we, in common with other railroads, give all the attention to these devices that we can. We have a test department, of course, and an engineering department and other means of determining the ultimate value of these things, and we try in the operating department to give them all the attention we can, with fairness to all concerned.

PRESIDENT: We have with us Mr. Peterson, of England. We would like to hear a word from him.

MR. L. H. PETERSON: I thank you for the honor you do me, but I am no authority on purchasing. Our best purchasing agents are our wives.

PRESIDENT: It just comes to my mind that we in the railroad end and you in industry have been working together pretty closely in making the improvement that has been made on the railroads in the last twenty years, and a great many things would never have been developed hadn't some one on

the railroads tried it out and made it a success. And I am sure the purchasing departments of the railroads are giving consideration to these things that are going to save a dollar or make a dollar equal a dollar and ten cents or more, but they do not want to buy for a dollar anything that is only worth ninety cents. That is one of the problems of the purchasing department, and one that the department is always up against in purchasing supplies.

I have just been reminded by our Secretary that this is the first time something has been for sale that a supply man did not have something to say. I have not called on a supply man yet, but I know some of you ought to have something to say. I see Mr. Chilcoat back there. He is on the other end of it.

MR. H. E. CHILCOAT: I would like to say this, I think the paper is characteristic of the gentleman who presented it, very able, easily understood, and much to the point. I can also testify that in his emphasis on the question of fairness, Mr. Young practices what he preaches. In such dealing as I have had with the Pennsylvania Railroad Mr. Young has been eminently fair.

PRESIDENT: Mr. Monroe, General Purchasing Agent, B. R. & P. May we hear from you on this subject?

MR. E. T. MONROE: I did not come to make a speech. I traveled about three hundred miles particularly to hear Mr. Young and it was worth it.

I agree with everything he has said and I simply want to emphasize the fact of co-operation between the purchasing and the stores departments with the using departments. Purchasing agents and storekeepers often make suggestions as to the use or substitution of materials. The using department may resent this at times and feel that it is not the business of the purchasing department to even suggest the use of materials. But what they should bear in mind is the fact that any savings that are effected by the purchasing or stores departments are not reflected in those departments but are reflected back to the using department and the purchasing and stores departments are simply the means for making the savings in the operating departments.

PRESIDENT: I see Dr. Unger in the audience. I wonder if he will not say something.

DR. J. S. UNGER: I do not know that I can add anything to the subject. I am much interested in Mr. Young's presentation. However, there is one factor that probably appeals to all of you, inasmuch as the conditions and the situation in regard to supplies in the large industries has undergone a material change within the last ten years. No large industry carries large stocks of supplies as was their former practice, owing to the fact that goods are more quickly transported from their place of manufacture to the place of consumption. Where we used to order supplies and expect delivery in two or three weeks, owing to the change in transportation—for which the railroads are very largely responsible—we expect to have delivery within a few days. Shipments can be made from Pittsburgh to reach New York in time for loading on a vessel bound for a foreign port within 18 hours after shipment. That is an example to show some of the changes in the conditions that exist in the delivery of purchases and stores.

By the way I heard a good story, brought back from the purchasing agents' meeting in New York and told by a purchasing agent himself. He said a man rushed into the police station and walked up to the Sergeant's desk and said "I got into a jam up street and pulled a gun out of my pocket and made a quick shot and killed a purchasing agent." The Sergeant replied, "You are in the wrong place. Down the hall the third door to the right is where you collect the bounty on purchasing agents."

Another story may have some bearing on present day business. What we need today more than anything else is more energy in business. Hussein went down to the market and bought a large quantity of goods at 12 cents a dozen. He secured a table and began selling them at 10 cents. One of his friends went up to him and said "Hussein, don't you know you are losing 2 cents a dozen on every dozen you sell?" He replied, "Yes, but it makes business brisk."

PRESIDENT: Mr. Buffington, have you anything to say?

MR. W. P. BUFFINGTON: I have enjoyed Mr. Young's remarks very much and I am very glad to have been here to listen to him. I can not add anything to what he has said.

PRESIDENT: Mr. Young, we did not succeed in getting any questions. Have you anything further to add?

MR. YOUNG: I do not know that I have anything further to say. I would be glad to answer any questions that might be asked. I seem to have proved the case of the purchasing agent, "not guilty."

MR. H. E. CHILCOAT: I would like to ask a question that concerns solicitation by those selling to the railroads. It has been a question in my mind in recent years whether solicitation should be carried on to the same extent as in the past. I speak now of casual calls when there isn't any particular business in sight, just casual calls in the nature of general solicitation. It seems to me they are not so necessary or desirable as formerly on account of the improved methods of purchasing developed by the railroads. I do not know whether I am right or not but that is the slant I have on it and if I am reasonably correct in this belief the selling expense of railway companies could be materially reduced.

MR. YOUNG: Mr. Chilcoat's question is one of considerable interest to me. It is easily answered by saying that it all depends. In my judgment, there is a great deal of unnecessary and non-productive solicitation. On the other hand a lot of solicitation is very essential to the buyer and to the engineering staff of the railroads; and to draw any hard and fast line between the two cases is a little difficult. When I first came into the purchasing department salesmen bored me not a little. More than anything else, after a man had been asked to see a certain person, who handled a particular subject or commodity for me, and who knew a lot more about the subject than I did, or ever would, he would say, "I just want to speak to Mr. Young a minute, to say how do you do." In he came, but his measure of a minute cannot be registered on a clock. But as one gains experience he does not seem to become irritated to the extent he did at first, and finally he almost comes to like it—if he is not watching the other thing he is supposed to be looking after. The kind of call I just mentioned—and there are a lot of them—is undoubtedly unnecessary and futile—entirely a waste of time on the part of the selling organization of the industry, and a waste of time of the purchaser, or the engineering department. I believe such practices are rapidly

disappearing. They are the old way of selling. In modern buying, the buyer must be fairly well skilled in his commodity. He must not know too much about it. If he does he is not a very good buyer. He must be flexible enough so that no one thing guides his decision. He must make a mosaic, and bring together all the particulars on any trade, and determine what values are to apply, then make his decision.

After his decision has been made is the time the salesman is essential, desirable and necessary. In other words, when the buyer has gone through all the sources of information at his command and has reached a decision on what he should do, it is then that the salesman can be of the greatest benefit and help to him. He learns from the salesman the true position of his company in reference to that commodity; their ability to serve, and the desirability of placing the order with that concern, if delivery is more essential than price. And I must say for the salesmen in those instances that the facts they bring to the railroad purchasing offices, are just as reliable as those coming to us from the engineering department, with their judgment as to what should be done. The salesman does not know when the buyer has formed his decision, so what shall he do? He must feel around, and that is what the really successful salesman does. He watches the situation. He has many ways to do this. I do not know how he does it. A great many salesmen never pay any attention to the men, or to our purchasing agent, until we have said "On Tuesday we will do so and so;" that is when they come in, and that is when we want them. Generally we want to shade the price or improve delivery, and we must convince the salesman that the shading of the price is justified or that the delivery we are asking, under all the circumstances, is fair and just to both the buyer and the seller. Does that generally answer the question?

PRESIDENT: Any one else? Mr. Sage, you are not here very often. We would like to hear from you.

MR. R. V. SAGE: At present I am neither buying nor selling. As one of the members ably remarked, my wife is looking after the buying, and she is doing a pretty good job. I have often thought that selling is a little like fishing. When you get a bite, pull up your hook. On that account it is pretty necessary to go to the fishing grounds where you have had luck before. Following up that line of reasoning, I have al-

ways figured that it was good policy to call on a customer occasionally, not to make myself a bore to him but to find out what his possible needs were in the future condition of the industry that you represent.

Mr. Young has given a very fine paper on the function of a purchasing agent and I do not think he has overlooked any of the qualifications of a good purchasing agent. I have often thought that the purchasing agent occupies a position somewhat similar to that of an advertising agent. Mr. Young and members of the Pennsylvania purchasing agents staff are receiving numerous visitors every day from all parts of the country and those visitors as a rule are men of considerable influence and acquaintance, and they gauge the facilities of the railroad by the treatment they receive from the purchasing agents. I think that one reason alone should show that it is necessary for the purchasing agent to be fair and square in his dealings with the salesmen.

PRESIDENT: Anyone else? Mr. Lanahan, what have you to say on this subject?

MR. FRANK J. LANAHAN: I am not looking for any bounties on purchasing agents! As Dr. Unger said, you go to the third door to the left. However, I do think that my industry at the present time is in the position of the second one about which Dr. Unger spoke, in the volume of business they are doing. Being on the other side of the fence, and having for many years occupied the opposite end of the table, as a salesman, I am somewhat tonight in the position of the fellow who was traveling West on the train when death overtook an unfortunate in the emigrant car. A minister was sought to conduct the funeral services, but none could be found. In the predicament, one of the travelers volunteered by saying, "I don't know anything about the usual burial service, but being from Los Angeles, if you want to hear anything about the heavenly sunshine and glorious climate of Southern California, I will be glad to officiate."

Mr. Young's definition of reciprocity reminded me of a story that was told rather frequently during the War. It had to do with one of our doughboys in France. Being on a furlough, he visited Paris, and becoming hungry, he went into a little cafe to get a sandwich. This he found delicious and inquired from the proprietor what he called it. The Frenchman replied, "Zat is ze

rabbit sandwich." The American boy wanted to know if anything else was added. "Oh yes," responded the restaurant proprietor, 'We put in ze horse meat too." "Tell me how you mix them?" asks the American. To this, the Frenchman comes back, "What you Americans call ze 'fifty-fifty,' ze one rabbit to ze one horse."

Present here tonight are a number of the railroad supply fraternity. They feel the responsibility that rests on their shoulders of developing and fostering the business interests of their respective companies. It is their duty to establish contacts, call upon and solicit requisitions from the purchasing agent. So these fellows are out in force tonight that they may imbibe allopathic doses of wisdom for peddlers from the "fountain of purchasing knowledge," hoping to learn of a panacea as to the successful way to approach a purchasing agent and be made the recipient of mutual confidence and respect. We can hope they derived benefit from the paper read tonight and a better understanding. Someday efforts for mutual consideration will be successful in recognizing that we are all striving to make a living and its the urge of each of us to succeed.

The speaker of the evening certainly has ascended the ladder in his chosen profession until he has reached the pinnacle now, being in entire charge of insurance, purchases and stores. This clearly indicates his ability. I only hope within the sound of my voice there are a few railroad salesmen who have done as well. We have listened to a masterly address. It seemed to me as Charley pictured that narrative tonight, it was like someone with a piece of canvas, a fine brush and pigments painting a lovely ensemble. Figures are often tiresome. Comparisons are odious frequently, but tonight we have listened to something well worth while. We have all enjoyed it and I think we are going home better satisfied for having listened to an honest-to-goodness purchasing agent, representing a large company. The remarks you have listened to from Mr. Reynolds and Mr. Monroe and Mr. Sage and Mr. Flynn and Dr. Unger and the others, I think have made us appreciate more the relative importance of the analysis Mr. Young has made of the purchasing agent's problem. The completeness with which he has presented the subject has earned the thanks of all of us who are here. Therefore, Mr. President, I move you that we testify our appreciation of his address and his kindness in coming here from Philadelphia to present it, by a rising vote of thanks.

The motion was duly seconded and prevailed by unanimous vote.

After further music by the orchestra and soloists from the Pittsburgh & Lake Erie Railroad, adjournment was duly had to the refreshment tables and a social hour.

J. D. CONWAY, Secretary.

RESERVED

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

$1.00 Per Year — 25¢ Per Copy

Vol. XXX — DECEMBER 18, 1930 — No. 2

"Roller Bearings For Locomotives and Freight Cars"

By T. V. BUCKWALTER, Vice President, The Timken Roller Bearing Company, Canton, Ohio

OFFICIAL PROCEEDINGS
OF
The Railway Club of Pittsburgh
Organized October 18, 1901

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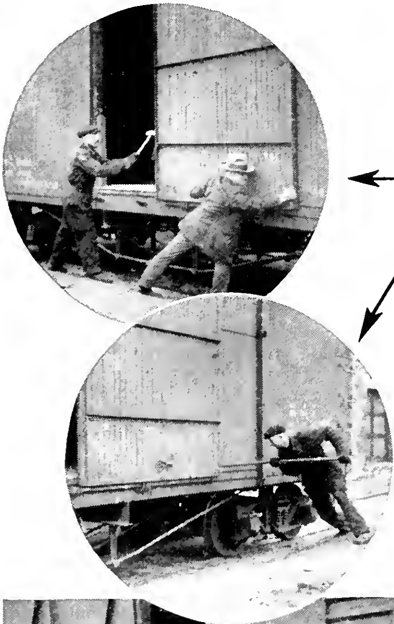
INDEX—ADVERTISERS.

"Nothing Rolls Like a Ball"



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OF
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Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING DECEMBER 18, 1930

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock, P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Altsman, W. H.
Anthony, R. H.
Askin, J. A.
Balzer, C. E.
Beeson, H. L.
Berghane, A. L.
Best, D. A.
Bittner, George
Borg, John E.
Burgham, M. L.
Carlson, F. R.
Carlson, Lawrence E.
Carmack, J. L.
Carson, John
Carter, William
Conway, J. D.
Coombe, A. B.
Coulter, A. F.
Cotter, G. L.
Crawford, A. B.
Crawford, D. F.
Croke, Thomas F.
Cunningham, R. I.
Dambach, C. O.
Davis, Charles S.
Descamp, J.
Diven, J. B.
Dobson, F. L.
Downes, D. F.
Downes, M. S.
Dudley, J. C.
Durkin, James E.
Edwards, C. H.
Emery, E.
En Dean, J. F.
Endsley, Prof. Louis E.
Farrell, G. R.
Flinn, R. H.
Frauenheim, A. M.
Fry, Lawford H.
Geisler, Joseph J.
Gerber, Harry L.
Gilg, Henry F.
Gorman, Charles
Gray, Guy M.
Haller, C. T.
Hansen, William C.
Heffelfinger, A. E.
Herlehy, David T.
Hilstrom, A. V.
Holmes, E. H.
Hood, C. E.
Hoover, J. W.
Horner, William
Howard, L. F.
Hughes, John E.
Irwin, R. D.
Johnson, A. B.
Kaup, Earle W.
Kaup, Harry E.
Kelly, L. J.
Kerr, C. R.
Kroske, J. F.
Kummer, Joseph H.
Lanahan, J. S.
Landis, William C.
Laurent, Joseph A.
Lawson, A. F.
Leban, J. L.
Lewis, Goodrich Q.
Lobez, P. L.
Loeffler, George O.
Long, R. M.
Longdon, Clyde V.
Lowman, John R.

Lowry, William F., Jr.
Lynn, Samuel
Maliphant, C. W.
Masterman, T. W.
Meinert, Henry
Misklow, C. J.
Misner, George W.
Moir, W. B.
Morgan, Homer C.
Moses, G. L.
Myers, Roy C.
McGeorge, D. W.
McIntyre, R. C.
McHugh, C. A.
McKenzie, Edward F.
McKinley, A. J.
McKinley, John T.
McLaughlin, H. B.
McNamee, W.
McNelty, A. P.
Nelson, W. M.
O'Leary, J. J.
Painter, Joseph
Perkins, Charles F.
Ralston, J. A.
Reeve, George
Renshaw, W. B.
Rushneck, G. L.
Saltic, Thomas
Sample, W. E.
Schmitt, Raymond F.
Schubert, C. F.
Seroky, Edward A.
Severn, A. B.
Shafer, J. S.
Sharp, H. W.
Sheets, H. E.
Sheridan, T. F.
Simons, P.
Smith, R. W.
Snitehurst, J. G.
Snyder, F. I.
Stamets, William K.
Stamm, Bruce B.
Stephen, James
Stoecker, J. P.
Stucki, A.
Sutherland, Lloyd
Thomas, Theodore
Tomasic, N. M., Jr.
Waldron, F. G.
Waterman, E. H.
Watt, Herbert J.
Weaver, W. Frank
Whalen, D. J.
Wheatley, William
Winslow, S. H.
Wright, John B.
Young, F. C.

VISITORS

Akins, E. M.
Beall, C. R.
Bone, H. L.
Bott, William J.
Brady, C. C.
Brandt, B. H.
Brown, Homer
Buckins, A. O.
Carruthers, G. R.
Chalmers, J. W.
Cook, Fred
Copper, A. M.
Dunham, C. W.
Evans, David A.
Ginttot, D. G.
Goodwin, Arthur E.
Helver, James M.
Hepburn, P. W.
Huston, Frederick T.
Johnston, F. D.
King, William R.
Kirk, W. B.
Lessig, J. F.
Lewis, S. B.
Lloyd, D. W.
Logan, J. W., Jr.
Marlow, G. A.
Menaglia, V. A.
Miller, J. C.
Mitchell, Paul S.
Mock, J. C.
Mullooly, C. J.
McGary, F. J.
Orr, Leighton
Pugh, A. J.
Rohyans, A. V.

Saline, N.	Smith, W. H.
Schlanger, Frank A.	Stamm, Wendell B.
Schubert, Fred E.	Thomas, H. N.
Seip, Russell G.	Van Sant, B. R.
Smith, Sion B.	Wilcox, R. J.

Young, John L.

The call of the roll was dispensed with as the registry cards give the record of attendance.

By common consent the reading of the minutes was dispensed with as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Buckwalter, T. V., Vice President, Timken Roller Bearing Company, Canton, Ohio. Recommended by D. F. Crawford.

Downes, Daniel F., Division Operator, Pittsburgh Division, Pennsylvania Railroad, 5939 Kirkwood Street, Pittsburgh, Pa. Recommended by J. T. McCarthy.

Horger, O. J., Assistant Engineer, Timken Roller Bearing Company, Canton, Ohio. Recommended by J. D. Conway.

Kirk, W. B., Test Engineer, Westinghouse Air Brake Company, 200 Delaware Avenue, East McKeesport, Pa. Recommended by Clyde V. Longdon.

Morgan, Homer C., Teller, McKees Rocks Trust Company, 613 Frederick Street, McKees Rocks, Pa. Recommended by J. E. Hughes.

Mullally, Joseph W., District Manager, Anaconda Wire & Cable Company, Oliver Building, Pittsburgh, Pa. Recommended by J. D. Conway.

McKinley, John T., Report Clerk, P. & L. E. R. R., 613 Broadway, McKees Rocks, Pa. Recommended by J. E. Hughes.

Pugh, Andrew J., Homestead Valve Manufacturing Company, Box "H", Coraopolis, Pa. Recommended by J. D. Conway.

Thomas, Harold N., Inspector, Carnegie Steel Company, 5908 Rural Street, Pittsburgh, Pa. Recommended by R. C. McIntyre.

PRESIDENT: In accordance with our By-laws these applications will be referred to the Executive Committee, and upon approval by them the applicants will become members without further action than the payment of the current year's dues.

SECRETARY: Since our last meeting we have received information of the death of S. C. Wolfersberger, Assistant Superintendent, B. & O. R. R., who passed away October 10, 1929.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

There being no other business, this brings us to the paper of the evening, which will be given by Mr. T. V. Buckwalter, Vice President, Timken Roller Bearing Company, Canton, Ohio, who will address the Club on the subject, "Roller Bearings for Locomotives and Freight Cars."

"ROLLER BEARINGS FOR LOCOMOTIVES AND FREIGHT CARS"

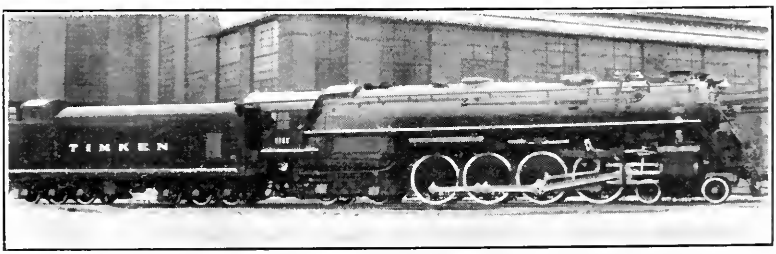
By T. V. BUCKWALTER, Vice President,
The Timken Roller Bearing Company, Canton, Ohio

TIMKEN LOCOMOTIVE

The steam locomotive is the greatest civilizing influence the world has ever seen. It is the chief distinguishing feature between the civilization of today and the Roman civilization of 2000 years ago.

The Roman civilization developed art, culture, literature, civil government and a military organization the equal or superior to anything existing today.

The Roman civilization lasted for eight centuries but it lacked the steam locomotive—and therefore was unable to



General view of the Timken Locomotive

transfer its military strength quickly from one part to another of its far-flung empire. The lack of transportation system based on steam power prevented the Roman and other early governments from taking advantage of their interior lines and defeating their enemies piece-meal. Their empire was gradually crushed by the weight of superior numbers from a wide variety of enemies exerting pressure throughout the length and breadth of the extended empire.

It can be truthfully said that the American and Continental civilizations of today have developed concurrently with the development of the steam locomotive. The greater security and strength of our present-day civilization rests upon the superior production facilities of our modern industrial organization and this, in turn, depends for its value and usefulness on a quick, certain, reliable and all-embracing form of transportation. The back-bone of this transportation is the steam locomotive.

Other forms of transport can be considered as supplementary to the steam locomotive and to a large extent have grown out of the tremendous development based on the steam locomotive. These could be mentioned briefly as comprising the automobile, motor truck, airplane, and steam power on marine transportation. This is true for the reason that previous to the development of the locomotive the commerce between nations, based on maritime power, was limited to the narrow territory serviced by earlier forms of transportation and which were contiguous to coast line and available seaports.

Transportation Growth

Future development of the steam locomotive will be influenced, to a much greater extent in the future than in the past, by the change in population which this country is undergoing at the present time. The increase in population in the nineteenth century was about 5% in the early stages of railway development and tapered off to about 3% in the later decades of the century.

Railway transportation was subject to a marked increase in mileage and capacity; first, to catch up with the transportation demands of the growing nation, and second, to meet the increasing transportation demands brought about by a higher scale of living and by the increase in population.

This situation is materially changed,—and is still changing—these changes being adverse to the railway situation. This is brought about by the marked decrease in population-increase,

being only about 1½% per annum during the last decade, with indications that the population will cease to increase and attain a fixed figure in 15 or 20 years.

This factor is further influenced by the relatively greater age of the individuals comprising a fixed population, with consequent reduction in commodities required in construction.

A particularly interesting feature of the above situation is that the railroad equipment, particularly locomotives, should be selected under present conditions for operation over a long period of time without material increase in the demands for transportation. This factor materially changes the picture as compared with the past 25 years, during which time it was possible to purchase large quantities of motive power and rolling stock with the certainty that the country would grow up to the transportation plant provided, particularly if the rolling stock or power did not happen to be selected in exact step with requirements as developed.

As compared with the foregoing situation, conditions in the present and immediate future incline to a condition whereby power and rolling stock should be selected for a set of transportation conditions which will be little—if any—affected by increase in transportation requirements. Therefore, if an error is made, there is small probability of correcting the error, due to the country growing up to the transportation machine.

All of the above indicates that the locomotives to be built in the immediate future should be built under specifications in recognition of the principle that transportation requirements are not to be subject to any material increase, as far as can be prognosticated at the present time.

Passenger Traffic

Passenger traffic has suffered a decrease in the past decade of approximately $400,000,000 annually. There is a probability that the railroad plant will retain the long-distance passenger haul, but the local passenger business is lost, with small probability of its ever being regained under existing conditions.

The influence of the automobile has been a marked factor in this decrease in passenger business and this influence is on the increase, rather than on the wane, the probabilities being that with further development of the hard-surfaced roads that a larger percentage of the local passenger business will be handled by the private passenger car, supplemented by the bus and, to a still lesser extent, by the airplane.

Freight Traffic Competition

Freight traffic has held up to a much more favorable extent than passenger. The automotive influence has been less marked in freight traffic. The motor truck has developed into a serious factor on short-haul business, and the probabilities are that this influence will continue to increase for some years.

It is doubtful if the short-haul freight business can be regained, and it is equally doubtful whether the motor truck will ever be a serious factor in long-distance freight transportation.

The chief influence of the motor truck, as regards the freight situation, will be the compelling and marked increase in speed in freight service, and this increase in freight traffic speed promises to be the most important change that will be witnessed in the railroad situation in the next decade. The prompt delivery of freight affects such an important economy in the manufacture of commodities that it is doubtful if American industry will ever be satisfied with the uncertain freight deliveries which prevailed previous to 1920.

It is believed that even without the competitive influence of the motor truck that the economies effected in industry through the reduction in inventories will force still greater increase in the speed with which freight is delivered from terminal to terminal.

It is believed, therefore, that freight traffic is entering a period of stability, marked with a gradual increase in volume considerably less than that which prevailed in the first quarter of this century.

Combination Freight and Passenger Locomotive

The situation as regards the competitive and population influences is mentioned on account of these influences favoring the development of a combination locomotive for either passenger or freight service. Passenger service is on the decrease and therefore the investment of heavy plant facilities for the transportation of passengers is not justified.

Freight service, other than products of mines, is subject to a series of conditions that demand operation at speeds approaching that of passenger service. The situation is influenced by a further important factor, in that the passenger traffic demands has a tendency to develop certain peaks which happily harmonize with slack demands in freight service.

Therefore, a combination locomotive suitable for heavy passenger service, and especially adapted for fast freight service,

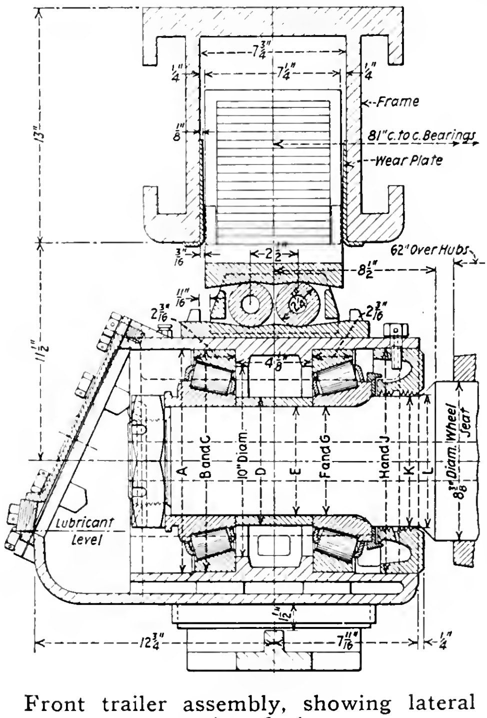
would effect a market economy in investment in power and in the maintenance of this power. It will be shown that the roller bearing is particularly adaptable to the development of combination freight and passenger locomotives.

The interchange of power between passenger and freight pools would permit the transfer in some cases of 200 engines. This effects a corresponding economy in capital investment.

Roller Bearing Influence on Locomotive Design

The introduction of the roller bearing on driver axles removes all limitations on speed as imposed by the bearing situation. Roller bearings of a size comparable with that required

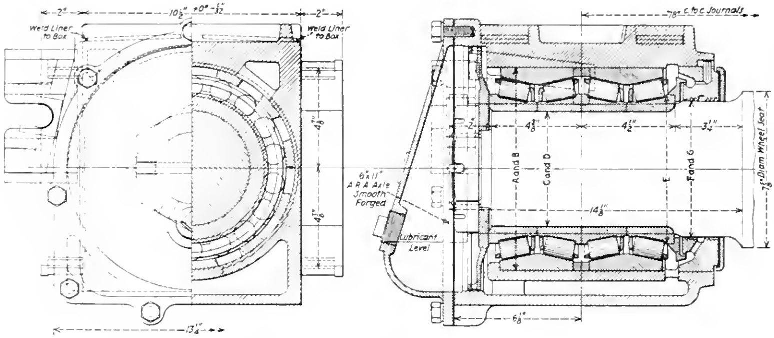
Engine truck axle with bearing partially assembled



Front trailer assembly, showing lateral motion device

on driver applications are in successful operation in steel mill and industrial service at speeds equivalent to over 150 miles an hour. The roller bearing surrounds the axle completely. The bearing provides full 180° to take piston thrust in both directions. The bearing encloses the axle at the bottom as well as the top. These conditions prevent any lifting of the bearing with respect to the axle and are a principal influence in eliminating driver bearing pounding. Vibration and pounding of main bearings and rods appears to be eliminated entirely in the roller bearing locomotive, this result apparently being influenced by the relative fixed location of the driver axles, maintaining thereby correct tram between the drivers and the rods.

Heating is entirely eliminated, not only on driver but on other wheel bearings on the locomotive. The temperature rise of the driver bearings averages 15 to 20 degrees above atmosphere. This condition should result in a material reduction in



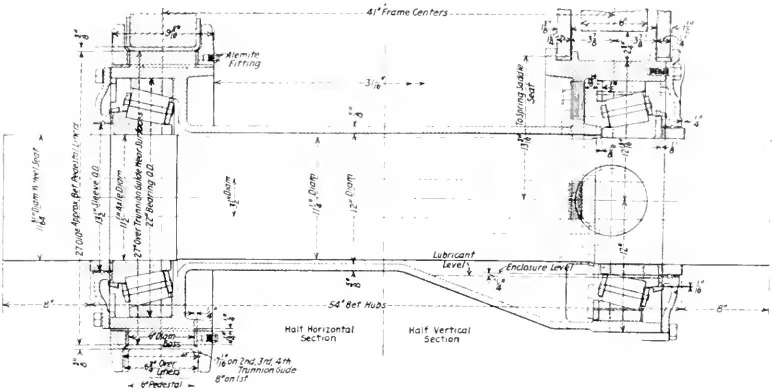
Bearing mounting as applied to tender trucks

axle breakage as it is generally recognized that axle breakage is principally due to heat-checks, resulting from high plain bearing normal operating temperature.

The maintenance of locomotive bearings, particularly the drivers, should be materially reduced and this is probably the most important advantage following the use of the roller bearing.

The power loss at low speed with roller bearings is relatively low, the loss of power in the bearings being negligible. This condition has the effect of increasing starting power of the locomotive as the high efficiency of the roller bearing applies at very low speeds. This has been borne out in practice as the Timken locomotive has been very effective in starting heavy trains, some of these trains being as high as 9,865 tons,

consisting of 131 loaded coal cars. This high bearing efficiency at low speeds permits of satisfactory use of valve events as usually applied to high speed passenger locomotives.



Sections through driving axle assembly

The experience to date indicates that the roller bearing locomotive is applicable to high speed passenger service, fast freight, and has been very sucessful in heavy freight service within the limits of its capacity.

Factors Controlling the Design

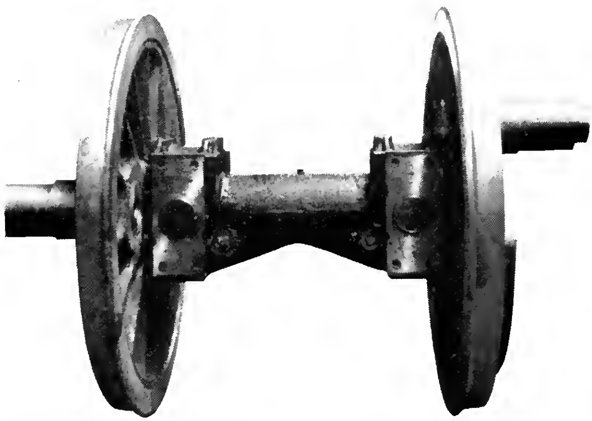
The decision to build a locomotive was arrived at with reluctance as it is realized that the Timken Company is not expert on locomotive design and would have much preferred to have proceeded with the locomotive bearing applications on power belonging to the railroad companies.

Considerable progress has been made on the application of roller bearings to passenger car equipment but railroads were very reluctant about the project of assigning a modern locomotive for the complete application of roller bearings, even though this application be made at the Timken Company's expense. Some progress had been made on the application of the roller bearing to the engine truck and tenders, and, to a lesser degree on the trailers, but the indications were that the driver application would, under normal conditions, have hung fire for a period of years. A locomotive so equipped, even at the Timken Company's expense, would be limited as regards experience, to the railroad directly interested, and the matter of interesting other companies would require duplicating this effort in each case.

It was considered therefore that time and expense could be saved by building a locomotive with the object of loaning it for demonstration purposes without charge to the railroads interested in observing the performance of roller bearings.

The roller bearing locomotive would naturally fall into comparison, willfully or otherwise, with the best of modern power constructed within the last ten years, and this condition indicated that the locomotive should be constructed of maximum size and capacity as limited by the clearance conditions permitting operations on the principal roads of the United States.

The WHEEL DIAMETER was selected as a compromise between prevailing practice in passenger and freight service. The diameter of 73″, while slightly larger than generally used in freight service, should produce equally satisfactory results in



Assembled driving wheel unit

heavy service on account of the higher efficiency of the roller bearing, and on the other hand higher rotative speed, permissible with the roller bearing, would permit operation in fast passenger service and permit handling any existing passenger schedule.

The BOILER was made of sufficiently large capacity to handle heavy trains at high speeds and this factor, together with weight limitation on certain roads, influenced the decision in favor of the 4-8-4 arrangement of wheels.

The WEIGHT was held within the limitations imposed by those roads having a maximum of 61,000 pounds per axle and

recognition of the fact that this would limit the capacity of the locomotive on roads permitting higher axle loads led to the development of a duplex weight system whereby a weight of 66,000 pounds per axle is used with 250 pounds steam where heavy axle load is permissible, whereas, an axle limit of 61,000 pounds with 235 pounds of steam meets the conditions imposed by roads having lighter axle limits.

The CYLINDER size of 27″ x 30″ was selected to develop ample power and utilize the maximum capacity of the boiler.

The development of the maximum capabilities of the roller bearings require that the subject of RECIPROCATING PARTS be given very careful attention and the specifications given to the locomotive builder of 85 MPH with a dynamic augment not exceeding 10,000 pounds require the use of light weight reciprocating parts. These involve the use of hollow heat-treated piston rod, one-piece piston, heat-treated nickel-vanadium crosshead and return cranks, nickel steel main and side rods. The dynamic augment was still further reduced by the cross counter-balancing method.

Builder

The American Locomotive Company was selected as the builder, the wisdom of this decision being evidenced by the fine spirit of co-operation displayed by the officials of this company. The design of the locomotive to accommodate the roller bearings in an efficient manner presented many difficult engineering problems; the solution of which was effected in a highly satisfactory manner.

Specifications

The specifications of the locomotive were developed after consultation with locomotive builders, specialty manufacturers, and a number of the mechanical officers of the railroads interested in the development. The specifications as finally developed follow herewith:

Owner	Timken Roller Bearing Company
Builder	American Locomotive Company
Type of Locomotive	4-8-4
Service	Freight and Passenger

Maximum rated tractive force (boiler pressure 235 lbs.)	59,900 lbs.
Rated tractive force of booster (boiler pressure 235 lbs.)	12,000 lbs.
Tractive force at starting (boiler pressure 235 lbs.)	71,900 lbs.
Maximum rated tractive force (boiler pressure 250 lbs.)	63,700 lbs.
Rated tractive force of booster (boiler pressure 250 lbs.)	12,800 lbs.
Tractive force at starting (boiler pressure 250 lbs.)	76,500 lbs.

Weight on drivers ÷ tractive force (boiler pres. 235 lbs.)	4.10
Weight on drivers ÷ tractive force (boiler pres. 250 lbs.)	4.14
Cylinders, diameter and stroke	27 in. by 30 in.
Valve gear, type	Walaschaert
Valves, piston type, size	12 in.
Maximum travel	8½ in.
Steam lap	1½ in.
Exhaust clearance	¼ in.
Lead	¼ in.
Cut-off in full gear, per cent	85
Weights in working order (boiler pressure 235 lbs.)	
On drivers	246,000 lbs.
On trailing truck, front	48,500 lbs.
On trailing truck, rear	55,500 lbs.
On front truck	67,500 lbs.
Total engine	417,500 lbs.
Weights in working order (boiler pressure 250 lbs.)	
On drivers	264,000 lbs.
On trailing truck, front	34,500 lbs.
On trailing truck, rear	59,000 lbs.
On front truck	60,000 lbs.
Total engine	417,500 lbs.
Total tender	294,000 lbs.
Total engine and tender	711,500 lbs.
Wheel bases:	
Driving	19 ft. 3 in.
Driving, rigid	12 ft. 10 in.
Total engine	45 ft. 10 in.
Total engine and tender	89 ft. 9¼ in.
Wheels, diameter outside tires:	
Driving	73 in.
Trailing truck, front	36 in.
Trailing truck, rear	44 in.
Front truck	33 in.
Journals, nominal diameter:	
Driving, main	11½ in.
Driving, others	11½ in.
Trailing truck, front	7 in. by 14 in
Trailing truck, rear	9 in. by 14 in.
Front truck	7 in. by 12 in
Boiler:	
Type	Extended wagon top
Steam pressure (weight on drivers 246,000 lbs.)	235 lbs.
Steam pressure (weight on drivers 264,000 lbs.)	250 lbs.
Diameter, first ring, inside	84¼ in.
Tubes, number and diameter	66—2¼ in.
Flues, number and diameter	194—3½ in.
Length over tube sheets	21 ft. 6 in.
Grate area	88.3 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	360 sq. ft.
Arch tubes	18 sq. ft.
Thermic syphons	105 sq. ft.
Tubes and flues	4637 sq. ft.
Total evaporation	5120 sq. ft.
Superheating	2157 sq. ft.
Combined evaporation and superheating	7277 sq. ft.
Tender	
Water capacity	14200 gal.
Fuel capacity	21 tons.
Wheels, diameter	33 in.
Journals, normal diameter and length	6 in. by 12 in.

Weight proportions (boiler pressure 235 lbs.)	
Weight on drivers ÷ total engine weight per cent	59
Weight on drivers ÷ tractive force	4.10
Total weight engine ÷ comb. heating surface	57.4
Boiler proportions (boiler pressure 235 lbs.):	
Tractive force ÷ comb. heat. surface	8.24
Tractive force X diam. drivers ÷ comb. heat. surface	602
Firebox heating surface ÷ grate area	5.47
Firebox heating surface per cent of evap. heat. surf.	9.44
Combined heat. surface ÷ grate area	82.4
Weight proportions (boiler pressure 250 lbs.):	
Weight on drivers ÷ total engine weight per cent	63.4
Weight on drivers ÷ tractive force	4.14
Boiler proportions:	
Tractive force ÷ comb. heat. surface	8.77
Tractive force X diam. drivers ÷ comb. heat. surf.	639

Co-operation of Specialty Manufacturers

The proposition to build the roller bearing locomotive was submitted to the principal specialty manufacturers and their co-operation invited. The response was very gratifying and developed into one of the most interesting examples of co-ordinated effort ever experienced in the American industry.

Fifty-two specialty manufacturers supplied their equipment on open account with arrangements whereby specialties will be paid for when the locomotive is sold. A list of specialties and equipment and companies supplying these parts follow:

Alemite Corporation	Alemite Lubrication
American Arch Company	Brick Arch
American Brake Company	Foundation Brake Equipment
American Locomotive Company	Power Reverse Gear, Lateral Motion Devices and Whistle
American Steel Foundries	Clasp Brakes on Tender Trucks
American Throttle Company	Multiple Throttle
Ardco Manufacturing Company	Automatic Drifting Valve
Ashton Valve Company	Air Brake Gauge and Steam Gauge
Barco Manufacturing Company	Blower Fitting—Low Water Alarm
Carnegie Steel Company	Leading Trailer, Tender and Engine Truck Wheels
Coale Muffler & Safety Valve Co.	Safety Valves
Consolidated Ashcroft-Hancock Co.	Inspirator, Boiler Checks, Cut-off and Back Pressure Gauge and Feed Water Heater Check Valve
Valve Pilot Corporation	Locomotive Valve Pilot
Detroit Lubricator Company	Flange Lubricator
DuPont deNemours & Co., E. I.	Duco Finish
Ehret Magnesia Manufacturing Co.	Boiler Lagging
Flannery Bolt Company	Flexible Stay Bolts
Franklin Railway Supply Company	Booster, Fire Door, Radial Buffer and Flexible Joints
Firebar Corporation	Firebar Grates
General Railway Signal Company	Train Control
Globe Steel Tube Company	Tubes and Superheater Flues
Gold Car Heating and Lighting Co.	Coupler Steam Head
Gould Coupler Company	Couplers and Farlow Draft Gear Attachments
Graham-White Sander Corporation	Sander and Valve

Huron Manufacturing Company	Arch Tube, Syphon, Smoke Box Inspection and Washout Plugs
International Nickel Company	Nickel Content in Boiler Plates, Rods, Frames, Crossheads, Roller Bearings
Locomotive Finished Material Co.	Pistons Complete with Rings
Locomotive Firebox Company	Syphons in Firebox and Combustion Chamber
Lukens Steel Company	Firebox and Combustion Chamber Sheets, Tender Sheets
Nathan Manufacturing Company	Force Feed Lubricator, Water Column and Coal Sprinkler
Okadee Company	Automatic Cylinder Cock, Front End Hinge, Blow-off Cock, Tender Hose Coupler, Water Glass Protector, Blower Valve and Feed Pipe Strainer
Otis Steel Company	Nickel Steel Boiler Plate
Parker Appliance Company	Auxiliary Tubing and Fittings
Paxton-Mitchell Company	Piston and Valve Stem Packing
Prime Manufacturing Company	Side Wind Shields
Pyle-National Company	Lighting System
Railway Steel Spring Company	Springs and Tires
Rees Manufacturing Company	Flue Cleaners
Standard Oil Company of Indiana	Lubricants
Standard Stoker Company	Type BK Stoker
Superheater Company	Type E. Superheater, Tangential Dryer and Pyrometer
Timken Steel & Tube Company	Timken Steel for Crosshead Guides, Link and Link Block
Union Asbestos and Rubber Co.	Insutape and Superinsutape
Union Steel Casting Company	Main Frames, Cylinders, Crossheads, Bearing Housings and Eccentric Cranks
Union Switch and Signal Company	Train Control
Vanadium Corporation of America	Vanadium Content in Axles, Frames, Crossheads, Eccentric Cranks
Vapor Car Heating Company	Vapor Steam Heat Equipment
Viloco Railway Equipment Co.	Bell Ringer, Pneumatic Whistle Operator and Valve
Waugh Equipment Company	Draft Gear
Westinghouse Air Brake Company	Air Brake Equipment Complete, Whistle and Pneuphonic Horn
Weston Electrical Instrument Corp.	Speed Indicator
Worthington Pump and Mach. Co.	Three Unit Feed Water Heater
General Steel Casting Corporation	Water Bottom Tender Frame, Bumper Beam, Engine Trailer and Tender Truck Frames and Cradle

The above list of co-operating companies is duplicated on bronze plaque located on the tender.

Roller Bearing Applications

Roller bearings are applied on the engine trucks, drivers, trailer, tender, booster, train control and valve pilot and flue blower.

The DRIVER bearing is the most interesting application and is an important factor influencing the design of the locomotive. The driver application is of the single bearing type and provides one row of rolls adjacent to each wheel. Both bearings are mounted in a one-piece housing extending across the frame, the axle unit thus comprises the axle and wheels, bearings and housing, thus insuring absolute maintenance of alignment between these respective parts, irrespective of the condition of rails and oscillation in the locomotive frame.

The use of the roller bearings on axles requires the maintenance of a high degree of accuracy throughout the entire

The tender journal box

period of locomotive life as regards axle tramming and side rod spacing. This condition precludes the use of adjustable features and led to the use of the trunnion form of mounting. These trunnion guides, made of hardened roller bearing steel, are trunnion mounted on integral bosses on the driver housing. The trunnion construction permits maintenance of full-surface contact with the pedestal liners which are also hardened and ground. The piston thrust is thereby transmitted through a hardened steel train of parts comprising the pedestal liner, trunnion and hardened liners welded to the axle housing. The construction is clearly indicated on the elevations and cross-section

of the locomotive and is shown in greater detail on section through the driver axle assembly.

The successful solution of the driver bearing application accounts for the exceptionally smooth-running of the Timken locomotive throughout the entire range of speeds up to 85 MPH and, in a large measure, for the elimination of pounding while under steam and when coasting. The roller bearing application apparently neutralizes the destructive effect of the reciprocating parts. The absence of vibration and pounding gives the impression that in some way the reciprocating parts have been thrown out of gear with the closing of the throttle.

Rear trailing truck box

The ENGINE TRUCK application is similar in general design to the driver in that use is made of a single bearing application, housing extending across the frame and trunnion guides interposed between the bearing housing and the pedestals of the engine truck. This application has seen extended and very successful use.

The TRAILER application on both the leading trailer and rear trailer axles is a direct replacement of the plain bearing. These applications are of the double bearing type which construction is necessary on outboard applications, on account of the desirability of mounting roller bearings in pairs.

The nominal size of the leading trailer axle is 7″ x 14″ and of the rear 9″ x 14″. The bearing housing for the rear trailer

axle is mounted directly in the trailer truck pedestals in the conventional way but the front trailer truck is provided with a self-centering lateral motion device which permits of 2″ lateral motion of the axle housing and bearing units within the trailer truck frame. This allows the front trailer axle to float freely on curves as high as 20° and meets fully the requirements of the I. C. C. as regards limited, free lateral motion in trailer truck applications.

The construction of the trailer is illustrated in the attached cut.

The TENDER TRUCK involves a new departure in railroad bearing application. This application is made in the conventional 6″ x 11″ pedestal type truck as widely used in locomotive service. The space limitations require the use of the quad type of bearing having four sets of rolls. The construction is indicated on the attached cut and involves a simple application inasmuch as the bearings are interchangeable and can be mounted on the axle without adjustment of any kind. An oil lifter is provided to insure circulation of lubricant through the bearing housing.

The BOOSTER application involves the use of a double bearing on each end of the crank shaft and a quadruple bearing in the idler gear. The roller bearing is particularly applicable to the booster service on account of the intermittent character of this service involving the application of full load on practically cold bearings and related parts. The higher effiicency of the roller bearing under these conditions materially increases the effectiveness of the booster. This is borne out by the high speed under which the booster operates on the Timken locomotive for considerable periods.

SMOKE BOX. An interesting application in the Smoke Box and Nozzle arrangement developed by Mr. W. F. Kiesel, Jr., and illustrated in the attached cut. A distinct feature is the use of a cylindrical netting surrounding a star shaped nozzle, the nozzle having an overall diameter of 16″ but an area corresponding with 7⅝″ diameter. The length of the surface contact between the exhaust blast and the products of combustion is about six times that of a round nozzle. The object of this development is the reduction in back pressure on the piston.

The Alco LATERAL MOTION arrangement is applied on No. 1 driver. The bearing housing and trunnion guides are

arranged to permit $1\frac{1}{4}''$ total lateral motion. This construction permits of operation on 20° curve. Drivers 2, 3 and 4 have $\frac{1}{4}''$ lateral.

The LUBRICATING system of the locomotive presents an interesting development. The roller bearing application on all wheels operate in a bath of oil. The experience on the Timken locomotive and on 160 locomotives in service on which some wheels are equipped with roller bearings, indicates that lubrication does not require attention oftener than two to four times a year. There have been examples of locomotive bearing application operating for two complete shopping periods without attention to lubricant on engine trucks. There is, however, a possibility of oxidization of the lubricant, entrance of water and grit, and, as a general proposition, the lubricant should be examined during reasonable periods above mentioned.

The Timken engine has been in service since April, 1930; while the lubricant has been changed once, this was done as a precautionary measure as the wastage at the time of the oil change had been trifling.

The main and side rods, motion work and all spring and brake fittings and pedestal liners are equipped with the Alemite system of lubrication.

Side Rod Bearings

Some difficulty was experienced in the early runs with hot side rod bearings. These bearings were modified, incorporating a Timken hardened steel liner, press-fitted in the rods. A three-piece floating bronze bushing operates between the hardened liner and the nickel steel pin. The O. D.s of the floating bushings are crowned and the hardened steel liner reverse crowned to match, the radius being approximately equal to the spacing between drivers. This construction appears to work in a satisfactory manner and has eliminated trouble experienced with the hot rod bearings. This condition is apparently due to the self-aligning principle, resulting from the use of the crowned floating bushing and corresponding crowned surface on the liner. The reciprocating motion permits self-aligning and apparently distributing the load over the entire surface of the pin.

Crosshead Guides and Valve Link

Crosshead guides and valve link operate in the open atmosphere and are subject to rapid wear due to the lapping action of atmospheric dust and grit. An effort was made to reduce

this wear by the use of roller bearing steel hardened and ground in the construction of the crosshead guides, the link and link block. This steel is tempered to hardness in excess of that of silica which is the chief constituent of atmospheric dust and grit. Therefore, such dust as imbeds in the crosshead slipper will not wear the guide to an appreciable extent. It has also developed that the friction is also greatly reduced over the use of crossheads and guides composed of soft materials as is evidenced by the fact that the temperature rise of the crosshead slipper and guides is only about 30° above atmosphere. This compares with the temperature rise of guides of soft material which is very high.

Operating Results

The locomotive has been operated on the New York Central freight service, Pennsylvania freight service and passenger service and Chesapeake and Ohio freight and passenger service and Erie freight and passenger service. The mileage at the termination of the Erie test is 39,034 miles, of which 18,057 miles were operated in passenger service. The operating results to date indicate that the locomotive has been quite successful in both passenger and freight service. It has handled a number of important passenger trains, including the "Sports-trains on the Pennsylvania, including some of the 20-hour, New man" on the Chesapeake and Ohio, and 11 Limited and Express York to Chicago trains, and the Erie Limited on the Erie R. R. The advice received from the railroad Operating Department is that the Timken locomotive is one of the finest engines ever built.

New York Central Freight

The New York Central test comprises 47 runs in freight service, handling trains as high as 125 cars, making a total of 4,561 cars, which were operated 632,753 car miles and 24,942,033 ton miles, including the engine. This work was handled with an average coal consumption of 48.75 pounds per thousand gross ton miles.

Water consumption average 6.87 pounds water per pound of coal.

The train performance was at the rate of 78,931 gross ton miles per train hour.

The average train speed was 28.

Pennsylvania Freight

The Pennsylvania freight record covers 49 runs comprising 10,667 miles, handling 4,558 cars, a total of 931,342 car miles, equalling 39,910,360 gross ton miles.

The coal consumption averaged 50.6 pounds per thousand gross ton miles with an average water rate of 80,078 gross ton miles per train hour.

The average train speed was 30.

The freight runs covered the territory from Altoona to Jersey City; from Columbus to St. Louis and from Crestline to Chicago.

Pennsylvania Passenger

The Pennsylvania passenger runs numbered 23, comprising runs over the Mountain Divisions from Harrisburg to Columbus, between Crestline and Chicago, and between Columbus and St. Louis. The passenger mileage was 7,871. The total number of cars handled was 289, making a total of 94,741 car miles.

The coal consumption averaged 7.81 pounds per passenger car mile and the water rate was 8.2 pounds water per pound of coal.

The locomotive demonstrated its capacity to run at a speed necessary to handle the fastest passenger schedules in the United States. A surprising ability in acceleration and in maintaining high average speed on grades were the principal advantages of the 4-8-4 type locomotive over the Pacific type.

C. & O. Freight

The Chesapeake & Ohio freight runs numbered eight covering 930 miles, handling 915 cars, making a total of 117,925 car miles and 6,291,116 gross ton miles including locomotive. Coal consumption averaged 36.55 pounds per thousand gross ton miles with a water rate of 7.06 pounds water per pound of coal.

The work rate averaged 135,710 gross ton miles per train hour. These runs were made over the Ashland Division between Russell, Ky., and Stevens, Ky. The average speed was 25.

C. & O. Passenger

Twenty passenger runs were made on the Chesapeake & Ohio, on the "Sportsman" between Toledo, Ohio, and Clifton Forge, Va., and on passenger trains between Clifton Forge and Charlottesville, Virginia. The total mileage was 7,128, handling 177 cars a total of 57,795 car miles.

Coal consumption averaged 9.8 pounds per passenger car mile with water rate of 7.9 pounds water per pound of coal.

Erie Freight

The Erie freight service comprises 28 runs between Marion, Ohio, and Meadville, Pa., the locomotive covering 2,922 miles, handling 2,003 cars a total of 192,194 car miles. The gross ton miles including the locomotive numbered 7,918,626.

Coal consumption averaged 79.81 per thousand GTM with a water rate of 7.41 pounds water per pound of coal. The coal consumption is higher on account of the topography of the line over which this test was made, this line covering the rolling country with a large number of approximately 1% grades, some of which extend for five or six miles. These conditions also cut down the work rate which averaged 51,103 gross ton miles per train hour. The average running speed, however, was favorable, being 27 miles per hour.

Erie Passenger

The passenger runs on the Erie comprise 28—between Marion, Ohio, and Hornell, N. Y.—a distance of 397 miles, the locomotive mileage being 3,058. The number of cars handled was 275 which totaled 27,934 passenger car miles.

The coal consumption averaged 11.49 pounds per passenger car mile and the water rate 8.15 pounds water per pound of coal. The coal rate was materially affected by the train size which on more than half the runs averaged from 6 to 9 cars. The coal rate on the Erie averaged 8.93 pounds per passenger car mile in express service with trains from 11 to 17 cars.

Work Done

The total mileage to December 12 is 40,035.

The aggregate passenger car service totals 180,173 passenger car miles.

The total freight service involves the operation of 20,110 train miles, hauling 12,106 cars a total of 1,871,214 car miles and 79,062,135 ton miles.

Summary of Tests

These tests indicate that the roller bearing provides a means of developing a combination engine which is capable of handling all freight service with the exception of the heavy drag coal service and, without making any changes whatever, will handle any passenger schedule in the United States and do both jobs in an efficient manner.

The coal consumption was less than that of the road on which it was operated. As against this, however, the train selections are favorable to the locomotive as all the tests were made on through runs. The coal and water figures, however, include all stand-by losses. The locomotive was not designed for heavy drag service but has handled trains comprising 132 cars, totaling 9,861 tons, excluding the locomotive, and starting these trains without difficulty.

The locomotive has handled coal trains weighing 8,500 tons over rolling country between the Ohio River and Columbus, Ohio. The valve events, however, are not proportioned for heavy drag service, but the experience indicates that while the locomotive is designed for heavy passenger and fast freight service, it will give a good account of itself in heavy, slow freight service.

The roller bearing in locomotive construction has improved the reliability of the machine. The Timken engine has been in service since April 15 and has taken every train into the terminal. It has started trains without issuing calls for a helper, notwithstanding some starts were made on momentum grades where the trainmen were of the opinion that the regular plain bearing locomotive would have required a call for help.

The locomotive has handled 12 steel cars up the Allegheny grade at Gallitzin without a helper and with this train saved three minutes on the standard mountain schedule.

Coasting

Free coasting is one of the outstanding features of the Timken-equipped locomotive. This feature accounts for the exceptionally smooth-riding characteristics of passenger trains handled by the Timken engine. It has been observed that in coasting at high speed at 70 MPH the train crowds on the engine and takes up the slack of the coupler but that the effort of one man will overcome the difference in rolling friction between the locomotive and the train and extend the coupler. This has been demonstrated repeatedly and doubtless accounts in a large measure for the exceptionally smooth-passenger train operation behind the roller bearing engine.

The rolling characteristics are sufficiently smooth that a number of times the fireman has not observed that the engineer has cut off the steam, this being due to the absence of pound in the engine and the absence of surging between the engine and the train.

Starting

The starting friction of the roller bearing is about 1/20 that of the plain bearing. The engine weighs 711,000 pounds, and this would indicate that 95% of this weight can be added to a train on level track without any increase in the starting effort. This amounts to, say 650,000 pounds. Reduced starting friction also applies to the excess load due to piston thrust which would be the equivalent to the weight on the drivers, multiplied by the adhesion factor, or say 1,000,000 pounds.

The reduced starting resistance would apply on, say 900,000 pounds of this figure. The experience therefore indicates that the roller bearing engine exercises an influence in the direction of smooth starting equivalent to a reduction of 750 tons in the train.

Bearing Temperature

The roller bearings run practically cold. A number of train-men commented to the effect that it was the first locomotive they had ever seen with frost on the driver bearings. The temperature rise of the engine truck and drivers is about 15° above atmosphere. That of the trailers is slightly higher, about 30°. While the tender runs still warmer, about 40° to 50° above atmosphere, this difference being probably due to the more effective air-cooling of the bearings on the leading wheels.

Economy in Coal and Water

It is not possible to explain the surprising results in reduced consumption of coal and water by the presence of the bearing alone. The best judgment indicates that the roller bearing saves between 10% and 20% of the total power development, the wheel bearing friction being practically eliminated. Final tests have not determined the machine efficiency.

The interesting feature is that the saving, due to the roller bearing, is applicable direct to the rail and this saving is compounded throughout the various features of the locomotive. If it is assumed that a certain amount of work is to be done, which is limited by train size, the power saving in the bearings effect, first, an economy in the cylinders due to early cutoff, involving corresponding reduction in consumption of steam. This, in turn, involves a second reduction in blast at the nozzle and effects more uniform draft conditions in the smoke box. The saving in one and two reduces the demand on the boiler and results in the working of the boiler at a higher point on the

boiler efficiency curve, effecting a still further reduction in power.

One, two and three re-act together to effect a reduction in demand on the furnace and permit again the operation of the grate on a proportionately higher point on the efficiency curve.

The saving in power at the wheels is therefore compounded four times, and this feature is believed to account for the economy in fuel and water which could not be accounted for by the saving in bearing friction alone.

Adhesion Ratio

The adhesion ratio on the Timken engine is 4.14. Notwithstanding this conservative adhesion ratio the Timken engine is very slippy, much more so than plain bearing engines with an adhesion ratio of four even. It compares very closely as regards slipperiness on the rail with the Lackawanna 4-8-4 engine which has an adhesion factor of 3.67. The indications are that the use of roller bearings on the driver requires, other things being equal, the addition of ½ full point to the adhesion factor. This would indicate a saving of 12½% in power and this probably applies through the entire range as the Timken engine, is inclined to be slippery, not only at starting, but also at high speeds about 50 MPH.

Dynamometer Tests

Dynamometer car records were obtained in freight service on the C. & O. between Stevens, Ky., and Russell, Ky., and between Marion, Ohio, and Meadville, Pa. Indicator cards were not taken. Data on this test is still in the course of preparation and will be published in a later report.

Some of the high points should be of interest. Draw-bar thermal efficiency of 7.04 for complete divisional run was maintained. The coal rate per draw-bar HP averaged from 2.58 to 3.27 pounds, on the river grades, and from 3.21 to a maximum of 4.04 on the runs over rolling country with grades up to 1.09%. The water rate averaged 18.76 to 22.1 pounds per draw-bar HP Hr., including auxiliaries and from 24.02 to 30.04 on the tests run over the rolling country. The figures are high on these last mentioned tests for the reason that the engine was worked 67% of these tests and drifted the balance.

The outstanding feature of the tests is the ability of the Timken locomotive to maintain high draw-bar pull at fairly high speeds, considering freight service. It has been possible to

maintain a cut-off of 71% at 39 MPH and this has resulted in the development of considerable excess power over and above that indicated by the Cole formula. This data is shown on the attached curves in which the actual performance is shown in comparison with the curves developed from the Cole formula. The high points on the test indicate performance in excess of the Cole formula of 8% at 10 MPH, 18.0 at 20 MPH and 30.0 at 30 MPH and 41.0% at 40 MPH. Trains and track have not been available to develop the full capacity of the locomotive at speeds in excess of 40 MPH and the power development figures indicated were obtained without special preparation as regards selection of train size and grades. The probabilities are that the power curve indicated will be exceeded with full cutoff.

The outstanding features are the development of draw-bar HPs of 3200 at 20 MPH, 4050 at 30 MPH, and 4600 at 40 MPH. A study of the tests thus far made indicate that with suitable train size and grade conditions the maximum power capabilities of this locomotive at higher speeds are in excess of 5000 HP. There is a probability that the complete tests throughout the entire speed range will be made after the locomotive has attained a mileage of 100,000.

Photographs and Drawings

Photographs of the locomotive and drawings showing the application of the bearings and principal parts are introduced herewith to more clearly illustrate the above descriptive matter.

Explanation—Increased Efficiency

The consumption of fuel, averaging 50 pounds per 1000 GTM on trunk lines and 33 pounds on Coal Divisions presents a situation in which an explanation for these results would be of material interest, particularly as the figures for coal consumption are about half those reported to the I. C. C.

A theory that has been evolved since these results are available, follows:

The steam locomotive consists of five essential units comprising:

(1) A machine consisting of crosshead, rods, cranks, axles and wheels.

(2) A steam engine consisting of cylinders and valves.

(3) A smoke box comprising stack, screen, nozzle, steam pipes.

(4) A boiler.

(5) A furnace.

Now the unit next to the rails and the function of which affects the other four units, is the machine. Reduction in loss of this machine affects the functioning of the other four units.

It can be considered for purposes of this explanation that the reduction in loss of machine is 12½%. This is a direct saving but by the time it reaches the grate this saving is compounded four times. We have a certain amount of work to do which involves a 12½% earlier cut-off which not only saves that amount of steam but the steam remaining in the cylinder at the point of earlier cut-off is used more efficiently.

In the next sequence of power development, the reduced volume of steam will issue through the nozzle at a reduced pressure and permit of the successful use of larger nozzle, larger area stack resulting in a further saving compounded on that of the machine and the engine.

The boiler is the fourth link in the chain of power development and it so happens that the boiler efficiency curve is very steep, boiler efficiency being about 85% light power demands, tapering off to 45% at heavy power demands. The reduction in demand effected in the machine, the engine, and the smoke box reduces the demand on the boiler, permitting boiler operation at a correspondingly higher range on the efficiency curve.

The grate, the fifth step, has an efficiency curve similar to that of the boiler. The demand on the grate will be affected by the improvement compounded through the first four steps and offers an explanation for the reduction of ½ the amount of fuel required to do certain work which was observed on some of the test runs.

This cycle of events also offers the explanation for the fact that the locomotive develops 4600 HP at 40 MPH where, under the Cole formula, the power would be 3250.

Money, as represented by the expenditure for fuel and supplies, compounded four times at 12½%, will give Rockefeller-Morgan strength to any American railroad.

Mistakes

This report would not be complete without a summary of our outstanding mistakes. Our most serious mistake is the tender. Water capacity is too small by 6000 gallons. We have no satisfactory excuse for this mistake.

Our second serious mistake is the size of the sand-box.

It should have been two to three times as large. This mistake is due to our ignorance of locomotive operation with adhesion ratios of four and under.

Our third serious mistake is the selection of material and thickness of the pedestal liners on the locomotive frame to accommodate the driving boxes. These followed typical railroad practice in design and hardening. The liners are too thin and the tempering is inadequate. It would have been much better to have adhered to our original plan of making these pedestal liners of Timken bearing steel, hardened under the eye of metallurgists trained in bearing tempering.

There may be other mistakes which will crop up as experience develops.

Summary and Deductions

The experience with the Timken engine to date indicates that we are on the eve of a decided revolution in locomotive construction. The continuation of the demonstration for a distance of 100,000 miles with results to date would indicate that no railroad would be justified in using plain bearings on a locomotive in view of the improvement in reliability and reduction in maintenance promised by the Timken locomotive.

Results to date indicate all passenger and freight locomotives ordered before the completion of the 100,000-mile test should have wide pedestal openings in the frame for the future application of roller bearings in drivers.

The Timken engine experience gives promise of effecting a reduction, not only in maintenance of power, but also in maintenance of rolling stock, due to the absence of shock and smooth running of the roller bearing engine, but in addition to this promises an immediate reduction in transportation costs following higher speed and greater reliability of the roller bearing locomotive. Maintenance of all locomotive parts and specialties should be reduced correspondingly with the reduction in vibration.

It is generally recognized by students of the railroad situation that it will be exceedingly difficult to revise the rate structure upwards. A reduction in railroad operating costs will eliminate the necessity for such upward revisions as this reduction will be equivalent to an upward revision of rates. It is always possible to put into immediate effect a financial improvement, effecting a reduction in expense without confliction with government bodies of any kind, either national or state, whereas,

an increase in rates is obtainable only after long-continued conflict with national and state bodies. Improvement in motive power and rolling stock is certainly the simplest solution.

Changing economic conditions throughout the United States point to a gradual increase in speed of train movements. This speed is already limited by the plain bearing and a desirable increase in speed can be obtained through either the improvement in the plain bearing or the introduction of the roller bearing. It is generally conceded that the plain bearing has reached its limit of development and the experience with thousands of passenger cars, and a complete freight train, and the Timken locomotive point emphatically to the introduction of the roller bearing as the next important improvement in railroad operation.

The passenger car, bus and motor truck are important factors in our transportation situation and the influence of these factors point in the direction of greater reliability, more comfort and higher speed. The roller bearing has made the passenger automobile, the bus, and the motor truck, and the roller bearing will also provide the means whereby the railroad can most successfully and effectively combat the loss of traffic arising from these agencies.

PRESIDENT: I am sure we have heard some things brought out tonight that we did not all know about before. It is very interesting indeed when anything new is on the market to have first hand information on it, and I believe the speaker has given us a very good description of what has been done. The subject is now open for general discussion, criticism or question. Some of you may have ridden this engine. Any statement of facts as you saw them would be in order.

MR. R. M. LONG: Mr. President and Gentlemen: I would like to ask a question about that freight train equipped with roller bearings as compared with one that is not equipped with roller bearings as to the stoppage of the train. What would be the difference in distance that would be required to stop the two trains?

MR. R. H. FLINN: I have seen this locomotive but I did not have the good fortune to ride on it because it happened to be in my territory when I was not there. I did hear a great deal of comment about the performance of the locomtive and I do not think Mr. Buckwalter has exaggerated in any particular the excellence of the performance of this locomotive.

There was one statement he made that I will have to chal-

lenge. He spoke of the coal consumption of 50 lbs. per 1000 gross ton miles, which is very good. I am not prepared to say what the coal consumption of the ordinary locomotive would be in similar service. No doubt it would be more than his locomotive. But the ordinary records, as I understand them, from the Interstate Commerce Commission are simply our gross coal consumption in freight train service divided by our gross ton miles, which includes terminal losses, helpers, local freight service and other forms of service, which gives a very much higher rate. So I do not think it is right to compare 120 or 121, which is the figure produced by this method for the American railroads, with Mr. Buckwalter's figure of 50. In the last seven or eight years the railroads have reduced that figure from 161 to 125, or nearly 25%, and that has been done without the roller bearing locomotive. If he can get a lower percentage with the roller bearing, (and I have no doubt he can but what it is I cannot say), I think it is a very valuable contribution to the locomotive art. As a matter of fact I think this whole roller bearing development on locomotives is an exceedingly interesting thing and gives promise of considerable value. But I think it is a little too early to say just what the value would be.

I do not want to ask any embarrassing questions, but it would be interesting to this audience to get a rough idea of what it would cost, not to equip an existing engine but what would be the additional cost of building a locomotive equipped with roller bearings over what it would be without roller bearings. I realize this was an experimental locomotive and it might be difficult to answer the question.

MR. EDWARD F. McKENZIE: I am interested in anything that makes the wheels go around easier. But I would like to know what the effect would be on the locomotive if you get into high water like we do on the Pittsburgh & Lake Erie once in a while when the river overflows. Would it force out the oil, like in an automobile, and affect the bearings, or will it go right through and be in good shape at the end?

MR. A. STUCKI: This paper reminds me of a trip I had from Chicago to Seattle on the Olympic, a train equipped with roller bearings. It was an up-to-date train on an up-to-date track, up to the minute in every respect and I shall never forget its comfort.

It is perfectly plain that when you reduce friction you do three things, at least. You save the coal pile, you save the

material from abrasion, and you have a more uniform operation. You cannot get around that. Of course the extent to which that has been done Mr. Buckwalter has given us and I want to say, that the paper no doubt will be read by all of us when it comes to us in print, and I for one am going to study it thoroughly if I have to read it over half a dozen times.

PRESIDENT: Are there any other comments? Mr. Gray, Superintendent of Motive Power, Bessemer & Lake Erie?

MR. GUY M. GRAY: I have been very much interested in the paper but I have no comments to make at this time. I think Mr. Buckwalter is to be complimented on his paper.

MR. SAMUEL LYNN: While the paper of the evening refers primarily to the Timken locomotive, the speaker also introduced freight and passenger cars, so I assume that that brings the carman into the discussion.

I believe in the address the speaker made the statement that one failure of the standard journal bearing, or one hot box, would cover the cost of equipping the car with roller bearings. I have made some estimates as to the cost of stopping a heavy tonnage train when necessary to set out a car due to a hot box, and putting it in condition and the application of new wheels, etc., and have also made inquiries among a number of my railroad friends, and have received various estimates, and am frank to admit that I have been unable to get any accurate data as to what it does cost. If I understood the speaker correctly, he made the statement that the cost of installation of roller bearings would be about 10% of the cost of the car: Does he mean by that 10% of the reproduction cost, or the original value of the car?

Like my good friend Mr. Stucki, I also had the privilege of riding one of the Milwaukee trains to Seattle about a year ago, in October, 1929, to be exact, the cars in which were equipped with Timken bearings, and I admit that we had a very comfortable ride. We had some of the Milwaukee Car Department officials with us a part of the journey, and in discussing the application of roller bearings from the statements that were made I assumed that the cost of application of roller bearings was approximately $800.00 per car. As this estimate was received more than a year ago, I would like to have the speaker advise if that is the approximate cost now, or if due to produc-

tion or decreased costs of material they have been able to reduce the cost below the figures I obtained at that time.

MR. D. W. McGEORGE: Mr. Buckwalter has spoken about numerous applications of roller bearings to engine trucks. No doubt he has made a study of the thrust on same. Most all roads have had trouble with fire cracks due to terrific heat developed on account of this thrust. Does Mr. Buckwalter have any figures on the amount of this thrust? I have heard this amounts to as much as 20,000 pounds per square inch or probably ten times as much as the bearing pressure in a journal. Of course this thrust is intermittent but on long curves it may be constant for some time. I am not sure of these figures as they were given to me by a competitor.

PRESIDENT: Are there any other questions? If not I will ask Mr. Buckwalter to answer the questions that have been asked.

MR. BUCKWALTER: In reference to the stopping of the roller bearing equipment, the roller friction is about one-fourth of one per cent, probably a little less than that. The braking friction is about 25%. If we assume those figures as being correct, the braking friction is 100 times the rolling friction. From these figures if a plain bearing car could be stopped at a certain speed in 100 feet the roller bearing car could be stopped with the same application of brakes in 101 feet. I think some papers have been published on that subject and the increased distance is between one-half and one per cent to make brake applications in order to stop at a certain point.

In regard to the use of oil in locomotive driver bearings instead of grease, the probability is that the bearing friction would be reduced but I understand there has been considerable difficulty in the attempts to operate with oil in maintaining continuity of lubrication, and it is probable that reliability is a more important factor in the selection of a lubricating means than the power saving or efficiency and this is probably the reason for the general use of hard grease at the expense of oil.

The lubricant on roller bearings is the standard valve oil. Valve oil is a very satisfactory lubricant, on account of the lower temperatures under which it must operate, and it has a satisfactory resistance to water.

As regards Mr. Flinn's comments on fuel consumption, the only information we have is the fuel consumption of the roller

bearing locomotive. We have not obtained the fuel consumption of the plain bearing locomotive but we know it must be under 120 lbs. But I have not heard of any figures down as low as 50 lbs. Before the Traveling Engineers Association in Chicago there was a paper read describing a locomotive operation of 8,000 miles in which the fuel consumption of that particular locomotive in freight service was 80 lbs. and that 80 lbs. was given us in a manner that indicated that the owner of the locomotive was rather proud of the performance. I haven't any exact figures on the plain bearing and I rather expected to obtain them at this meeting.

The additioal cost of the roller bearing locomotive, as I view the matter, at the present time, is about 10% over that of the corresponding plain bearing locomotive. Those figures will be subject to considerable revision as we obtain more experience in manufacturing housings and fittings to accommodate the bearings. The bearings themselves are not so much more expensive but some of the housings and fittings are, particularly the hardened steel parts to resist the piston thrust and the driver bearings. I think the additional cost of 10% is a fair figure. That is as accurate as anything we know at present. And in taking this cost of 10% consideration should be given to the additional power the roller bearing locomotive develops over and above that of the corresponding plain bearing locomotive. I do not know of any eight coupled plain bearing locomotive that develops over 3800 h.p. at 40 miles an hour. And if the roller bearing locomotive of corresponding size develops 4600 that is a material advantage particularly at high speeds at which freight must be operated in the future in this country to hold the competitive struggle against the motor truck.

The question of Mr. McKenzie as to the effect of water. If an engine or car operates through water of sufficient depth to flood the housings, the oil and water must be drawn out and fresh oil added within a few days. There is no immediate danger because corrosion is rather slow and does not have any immediate results. But if that water remains in the housing for a period of months it will certainly attack the roller bearings.

I appreciate Mr. Stucki's remarks on the roller bearing as applied to the St. Paul and his experience thereon.

In regard to Mr. Lynn's question on the cost of hot boxes, we have been trying to find out what is the cost of a hot box. We have arrived at a figure of $25 per hot box. We have had

figures all the way from \$5 to \$200 per hot box. An analysis of what happens when a hot box takes place would be interesting. You know more about it than I do. We have first the stoppage of the train and of the traffic back of it; the crew going back to examine the train and see what happened and how serious it is; then going ahead at slow speed to a set off track; coupling up the train and going on. Then we have the shop operation and the cost of making repairs to the car and getting it into a central shop where complete repairs may be made, where that involves the application of a new axle. Anything from \$10 to \$200 may be involved, and if we assume \$25 as a fair average, that \$25 would pay interest charges on the additional cost of applying roller bearings on a freight car. The problem we set ourselves is the application of roller bearings to a 50 ton freight car for not to exceed \$300. From what we know of the subject if we can obtain this result and sell the necessary equipment at a price not to exceed \$300 it would justify the use of roller bearings on freight train equipment. If it saves one hot box per year per car it would pay the interest and obsolescence on that cost.

Also it would permit higher speed; it would reduce car body rock because the lateral motion of a roller bearing housing is against a fixed resistance and the tendency is to counteract the free rolling of the car body, whereas the lateral resistance of a plain bearing is zero. That encourages the development of car body rock and leads to more severe blows on the rail. The experience we have of over 100 cars indicates that the roller bearing will reduce the severity of car body rock. And I believe the hot box will save the cost.

Another point is that freight must be moved at high speed. The automotive industry is engaged in the development of power application to five ton truck equipment to be equipped with pneumatic tires that will develop 150 to 175 h.p. and move freight along the highways at passenger automobile speed, around 50 to 55 miles an hour. That is going to cost more money than railroad freight movement but it reduces tremendously the cost of doing business in an industrial establishment. It reduces the inventory item in a large factory as much as two or three million dollars. I am convinced that high speed freight is coming; that the economy effected in manufacturing the products of commerce will justify the cost of high speed freight. The railroads must meet this competition of the motor truck. Experience with the roller bearing locomotive in handling some

80,000,000 ton-miles developed this, that the average speed between terminals is 86% higher than the average railroad speed which is 12½ to 13 miles an hour. That average speed developed a certain number of miles per hot box. The average behind the Timkin locomotive at this higher speed is 92% more hot boxes on the train. That indicates higher speed must be paid for in more frequent hot boxes. The answer is a better plain bearing or a roller bearing. We think at that cost of $300 per car, neglecting the cost of the side frame because that would have to be changed any way to comply with the new regulations of the A. R. A. is entirely justified.

With reference to Mr. McGeorge's question as to the amount of thrust on an engine truck bearing, the best information we have is that it may amount to about 80% of the weight. That figure is about twice what we use on freight car and passenger car thrust reactions. The bearing we will provide for it will take about 120% of the weight. We provide 120% thrust capacity measured against the radial capacity of the bearing.

We haven't any more exact information than that. Probably the reason why thrust plates on engine trucks and drivers give so much trouble is because they are radial plates and centrifugal force throws out the lubrication and after a few miles they have dry surfaces operating against each other in high speed, and even if the unit pressure is not high the development of heat is high enough to develop heat checks observed on engine trucks. On the driver bearing or the engine truck bearing, the thrust reaction on the roller bearings is taken entirely on the roller surfaces with a frictional ton of probably less than ¼ of 1%.

MR. D. F. CRAWFORD: We have heard a most unusual and a most interesting paper, and one that I think has added greatly to our information on a most interesting development not only of the locomotive and passenger car, but a very good idea of the competition the railroads have to meet. Therefore I move a rising vote of thanks to Mr. Buckwalter for his very interesting paper.

MR. SAMUEL LYNN: I would like to second Mr. Crawford's motion.

The motion was put to rising vote and prevailed unanimously. There being no further business

ON MOTION, Adjourned.

J. D. CONWAY, Secretary.

In Memoriam

S. C. WOLFERSBERGER

Died, October 10, 1929

OFFICIAL PROCEEDINGS

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By THOMAS H. QUEER, Sales Engineer, Pittsburgh Coal Company, Pittsburgh, Pa.

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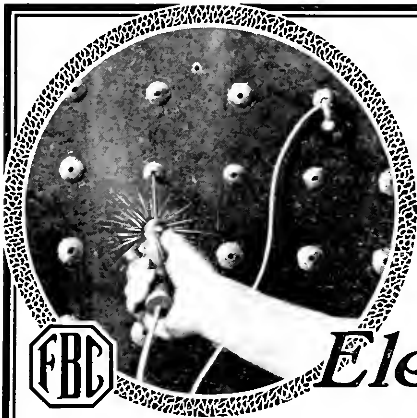

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*—Deceased.
†—Resigned.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
JANUARY 22, 1931

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

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Miller, J. C.
Mock, J. B.
Morrissey, John G.
Meyers, Frank C.
McCar, J. G.
Ondrizek, Charles L.
Pollock, H. J.
Pratt, Frank W.
Pursglove, Samuel
Queer, Thomas H.
Rankin, W. D.
Schmitt, Leo J.
Scott, J. M.
Shaw, John
Shetland, A. C.
Smith, Sion B.
Smith, W. H.
Snyder, H. C.
Topanelian, E., Jr.
Vollmer, Paul F.
Watts, J. C.
Weir, G. E.

The calling of the roll was dispensed with as the registration cards give a record of the attendance.

By common consent the reading of the minutes was dis-

pensed with as the Proceedings have appeared in printed form and been distributed to the members.

The Secretary read the following list of proposals for membership:

Erickson, L. S., Traveling Railroad Secretary, Y. M. C. A., 407 Calder Building, Harrisburg, Pa. Recommended by J. D. Conway.

Kusick, Harry F., Union Switch & Signal Company, 120 North Homewood Avenue, Pittsburgh, Pa. Recommended by C. O. Dambach.

Larsen, O. C., Secretary and Treasurer, The North American Coal Corporation, 826 Wabash Building, Pittsburgh, Pa. Recommended by C. O. Dambach.

Miller, A. A., Chief Electrician, Montour Railroad Company, 5409 Carnegie Avenue, Pittsburgh, Pa. Recommended by E. A. Rauschart.

McCully, D. L., Supervisor, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by W. C. Landis.

Queer, Thomas H., Sales Engineer, Pittsburgh Coal Company, Oliver Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Schwab, J. B., Audit Clerk, Pressed Steel Car Company, 1808 Rhine Street, N. S., Pittsburgh, Pa. Recommended by G. M. Van Wormer.

Seiler, William Roy, Boiler Inspector, Montour Railroad Company, 310 Johnston Avenue, Hazelwood Station, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Sievert, W. H., Salesman, James B. Sipe & Company, 1322 Juniata Street, N. S., Pittsburgh, Pa. Recommended by E. A. Rauschart.

Yeakel, J. C., Assistant Engineer, Montour Railroad Company, Apartment 3, Albert Apartments, Coraopolis, Pa. Recommended by E. A. Rauschart.

PRESIDENT: When these applications have been approved by the Executive Committee, in accordance with our By-laws, and the dues for the current year have been paid, the gentlemen will become members without further action.

The Secretary read an invitation to the members of the

Club from the National Paving Brick Manufacturers' Association to attend their twenty-fifth anniversary meeting February 5 and 6, 1931.

PRESIDENT: Is there any further business to come before the meeting at this time? If not, we come to the paper of the evening which will be given by Mr. Thomas H. Queer, Sales Engineer, Pittsburgh Coal Company, who will address us on the "Modern Coal Industry." It gives me pleasure to introduce to you Mr. Queer.

"MODERN COAL INDUSTRY"

By THOMAS H. QUEER,

Sales Engineer, Pittsburgh Coal Company, Pittsburgh, Pa.

I would like to say in behalf of the Pittsburgh Coal Company that we are very much pleased to be given the opportunity to make some remarks to this particular organization because of the fact that we are in daily contact with many of you and you are at least known to us pretty well.

Another thing I want to say is that our subject is a pretty broad one, "The Modern Coal Industry," and I have no thought of being able to entirely cover that tonight. However, I feel that we will all recognize the fact that the Pittsburgh Coal Company is one of the leading companies in the modernization of the coal business, and I have a motion picture that fairly well represents the activities of our Company from underground to our coal markets, which will serve to illustrate the trend of the industry.

Before showing the picture it might be well to recite a little of the history of the Company, which is almost the history of the industry in the district. Not many years ago, in fact going into the year 1925, the Pittsburgh Coal Company was a company in name only, at that time having not a single mine in operation. During the year operations were resumed on a very small scale, much attention and thought being given to scientific research as related to the mining of coal, the preparation of coal and also to the sale of coal. Out of that has come much activity that today is attracting considerable attention, and which has established the Pittsburgh Coal Company as one of the leaders, if not the leader in the modernization of the coal industry. Many cleaning plants have been built and much has

been done in the way of underground improvements, and our sales today are not so much a matter of selling a car of coal, because the customer is accustomed to using coal, but instead, of selling him the exact kind and size of coal that are required to meet his specific conditions.

We will now show the picture and I will endeavor to explain it as we go along and answer any questions you may wish to ask.

The purpose of the motion picture is to make a presentation of our product showing the various phases of operation necessary to its production.

Our product is known by the trade name of "Champion" and we introduce it by a series of athletic engagements, each showing the champion to survive the conflict, such as horse racing, auto racing, baseball and prize fighting, the champion in each case possessing the mark of distinction or the ability to surpass. This leads us up to our product "Champion."

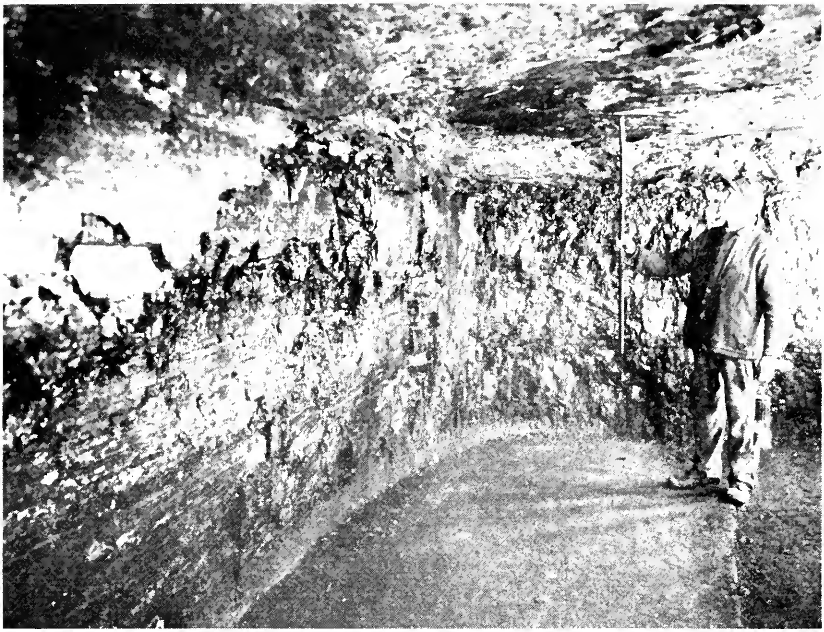
The view of a representative mining village brings to mind that the first step in modernizing was to make home and living conditions for the workmen and their families the best possible; this has been done by putting the buildings in good condition, equipping them with electricity and all modern sanitary equipment. Good schools are provided and active welfare work carried on.

In such an environment we find our miners at work in a happy frame of mind, receptive to the rules and regulations and new ideas pertaining to their work. Consequently all types and kinds of mining machines, loading machines, etc., have been experimented with and some of them more or less adopted as standard equipment.

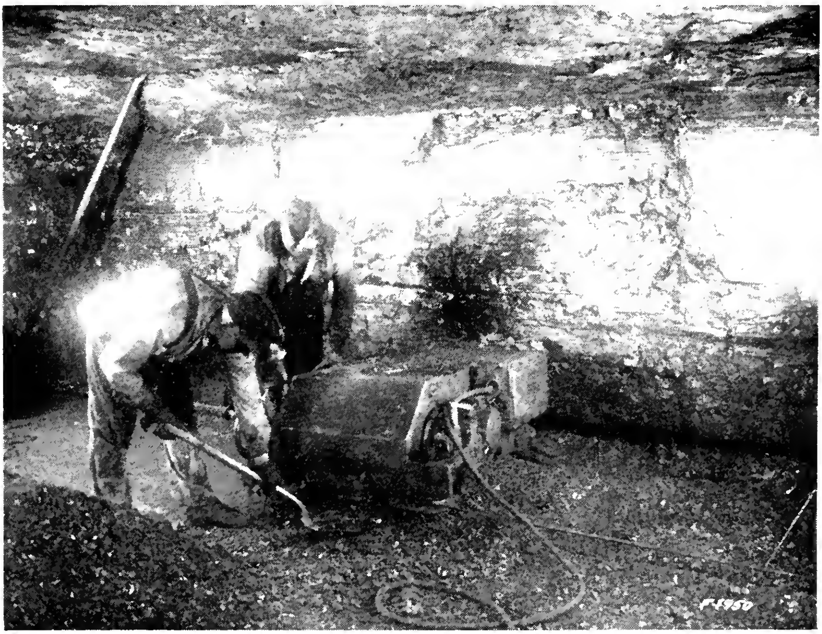
In the picture you see a shortwall undercutting machine, the purpose of the undercut or cutting rather, since there are machines that top cut and center cut, also machines that shear the coal, or, in other words, cut from top to bottom, is to make an open end so that the coal when blasted can move against less resistance than otherwise.

The loading machines are quite rapidly finding a permanent place in the modern coal mines, they relieve the miner of the laborious work of shoveling the coal into the cars, the miner becomes somewhat of a mechanic or machine operator.

A very important phase of the operation of a coal mine is the transportation of the loaded mine cars from the working place to the tipple. The output of the mine depends upon hav-



A working place ready to be undercut, a fire boss examining roof and testing for gas before allowing the cutting machine to enter.



A Shortwall undercutting machine in operation.

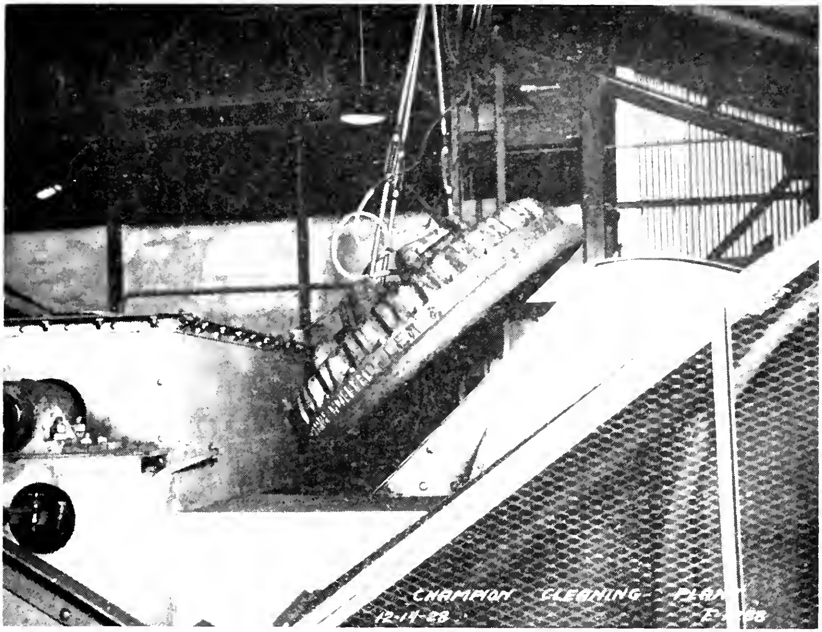
ing good track and good rolling stock. In this picture you see a train of 82 mine cars drawn by a 20-ton electric locomotive. Block systems and dispatchers such as you railroad men are familiar with are employed to expedite the handling of the loaded and empty trains. A mine producing 7,000 or 8,000 tons per day presents quite a transportation problem.

A dispatcher at work.

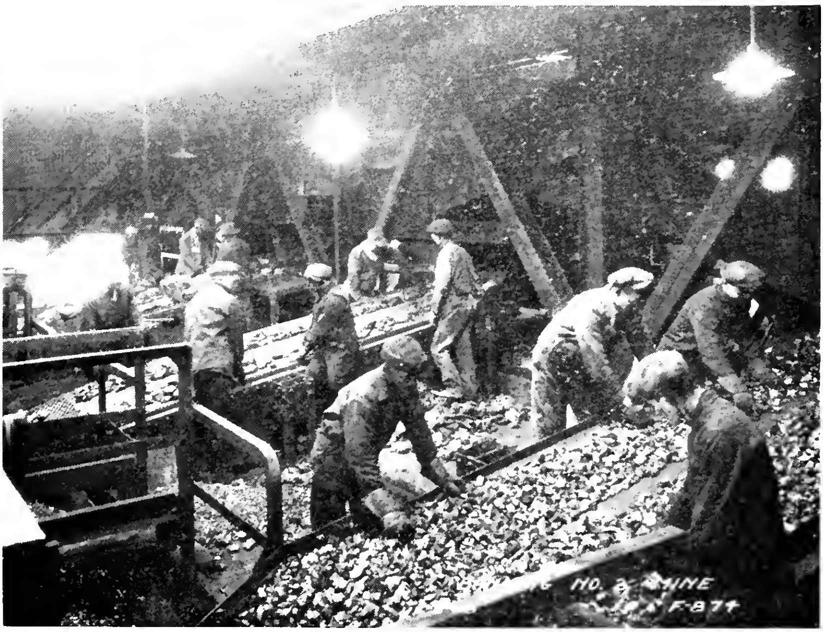
The coal after reaching the surface, instead of being passed over a coal tipple for cleaning by hand and screening, it is now by the modern idea passed through a mechanical cleaning and screening plant, the operation of which is entirely automatic, eliminating the variable elements for which the product by the old method is noted.

Out of consideration more or less for the railroad locomotive men, a magnetic separation of tramp iron from the coal was the first step of our cleaning operation.

In all the mechanical cleaning processes the fundamental principle of separating coal from impurity is based on the difference in weight of materials, so it narrows down to a separation by gravity. Whether this gravity is set up mechanically or by building up a solution of sand and water or by air pres-



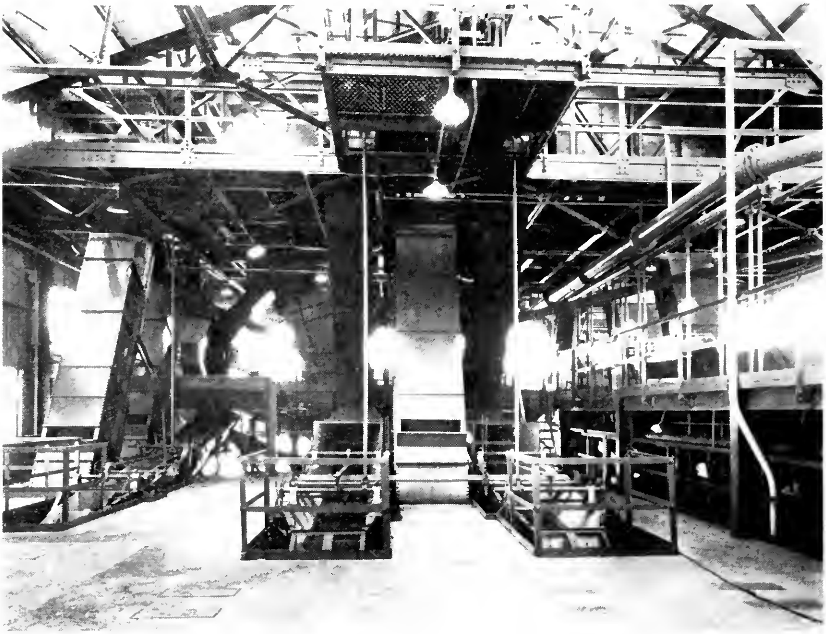
A magnet for removing tramp iron from the coal.



A modern coal cleaning and screening plant of just a few years ago.

sure, or what not, its purpose is the same. All the processes have their relative merits, especially so in comparison with the methods largely employed until recent years.

The troughs are known as launders, into which raw coal and water pass at a predetermined rate, allowing the heavier material to settle to the bottom, to be taken out of the system through Rheolaveur boxes. The lighter material or cleaned coal passes on to screens for dewatering and sizing. The operation is more or less continuous and considerable of the float material is re-circulated which tends towards more thorough cleaning.



An interior view of a Rheolaveur Coal Cleaning Plant.

We have a very complete and modern laboratory where all determinations of coal value are made. This is done to control the operation of cleaning plants, as well as to assure the trade of the exact quality of coal that has been sold them. Several views of the laboratory operation are shown. In addition to this laboratory, which we speak of as the Central Laboratory, we also have local laboratories at the cleaning plants, all of their work being checked at Central Laboratory.

The present day requirements of coal not only necessitates supplying coal of specified quality, but also of special sizing as

well. We are equipped as the picture shows, to load about any desired mixture of our standard grades. Many of the railroad companies are finding these specially sized grades to be almost the ideal of locomotive fuel.

Several standard grades of coal, both as to size and quality, are made regularly to meet the general requirements of this trade. For special purposes, however, the special sizes and mixtures of sizes in various proportions are found to do a very efficient job.

In the picture you see the standard grades; pulverizer, stoker, stove, furnace, jumbo furnace and Domestic Block.

The distribution of our product is rather broad, extending from the Middlewest to New England and to some foreign countries.

Champion No. 1 Plant.

This is a view of a modern preparation plant, which you can realize makes a modern plant of a few years ago suffer by comparison.

PRESIDENT: I am sure we have all enjoyed seeing this picture and I imagine some of us have questions we would like to ask. It is a very interesting subject. We could not run

most of our industrial works today without some coal. We use coal or its products in almost everything we use today. I see Mr. Flinn, of the Pennsylvania Railroad. I wonder if he has any comments on the subject.

MR. R. H. FLINN: Mr. Chairman, I am certainly glad to say a few words. I was hoping some of the coal men would say something. I came here to learn something about the coal industry. While we do know in a general way what is being done in the modern coal industry in providing a prepared coal of proper grade, I did not realize just how far that has gone in some of these preparations.

I think that the best thing we can do for the coal industry is to endeavor to provide air tight cars. I am not so sure that we will not be shipping in box cars pretty soon. I hear some one near me remark that they are already doing it, though I guess the tonnage is not yet very large.

There are several very interesting things about this job. One of the things that worries us on the railroads, in addition to our other difficulties, is the fact that we would like to haul more coal. I do not know whether they will be able to help us in that direction or not, but certainly the interests of the coal industry and the railroads are very largely mutual. We are not only large consumers of coal but coal producers are very large consumers of transportation, and we hear a great deal now days about gas and oil and other things that we are very much afraid will take a great deal of coal traffic away from us. I wonder if Mr. Queer would make a few remarks on that subject. I have been reading a great deal about it lately and I am trying to seek information and get some idea in my own mind at least of what these modern changes in distribution are going to mean to all of us, not only the railroads but industry in general.

MR. QUEER: Coal will always stand out as having some economic advantages over competitive fuels. I feel unqualified to venture an opinion as to the effect on railroads of the conditions Mr. Flinn spoke of.

PRESIDENT: Mr. Macfarlane, perhaps you can throw some light on this. Mr. Macfarlane is General Fuel Inspector, New York Central Lines.

MR. MALCOLM MACFARLANE: I have a very interesting little article here that I copied from a magazine, showing

how they did things 103 years ago. This was taken from the Readers Digest of June, 1929.

In Ohio in 1828, when a school board was asked for permission to hold a discussion in the schoolhouse as to the use of the new steam power on railroads, it gave its answer in these historic words: "You are welcome to use the schoolroom to debate all proper questions; but such things as railroads are impossibilities and rank infidelity. There is nothing in the Word of God about them. If God had designed that His intelligent creatures should travel at the terrific speed of 15 miles per hour by steam, He would have foretold it through His holy prophets. It is a device of Satan to lead immortal souls down to Hell."

And in that day even Boston warned ominously that the jars of such unholy speed would lead to "concussion of the brain."

The first engines were called "Puffing Billies," "Hell on Wheels," "Snorting race horses" and so on. Mobs often tore up tracks and threw rotten eggs at construction gangs.

Stephenson's locomotive was placed in operation September 27th, 1825.

Wood was the first fuel used. Until processes were devised to use blasts of air to force a coal fire, coal did not react well.

Evry road had a different gauge in width; so when a railroad was made up of many different links, as were the New York Central, Pennsylvania and Baltimore & Ohio, the passengers had to get out and transfer.

Tom Thumb locomotive constructed in 1829 by the Baltimore & Ohio.

Dewitt Clinton locomotive was built in New York and operated on the New York Central Railroad in 1831 and in that day it was called "A beautiful light race horse." Speed attained 15 miles per hour.

Today, over that same Hudson & Mohawk road and many others dash locomotives carrying 25,000 gallons of water and 30 tons of coal fed by automatic stokers.

Now we come down to that point of automatic stokers. We have on the American railroads 13,000 stoker equipped locomotives. That stoker operates with a worm gear. Mr. Crawford can tell you more about that than I can. If the coal contains mine spikes, machine bits, nuts and bolts, that stoker will stop and you will have engine failure. Therefore these coal operators have to put in modern apparatus such as you saw there that has magnets arranged to take out this iron to elim-

inate the possibility of stoker failure. Preparedness is the watchword today.

It is not only the coal companies, but we will have to take a little of that blame. The section foreman in shoveling up stone ballast and railroad spikes throws that on top of the coal. That goes to the coal box pockets and goes to the stoker and it stops, with delay on the road and some limited train is held up and I can't get back to New York. I can't ride on the Broadway Limited so I will have to go on the P. & L. E.

I wish to thank you very much. For this is a progressive age that we are living in. The industries, the coal industry, the steel industry, the railroads, are all keeping to the stride of progress. I just wanted to point out that question of magnets to get the iron out. It is very important. I thank you.

PRESIDENT: I think Mr. Flinn touched on a subject which we as railroads have got to think about. When we begin to ship that very fine coal we cannot ship it in sieves. It is all right to screen coal in a sieve, but when it comes to that finer coal it is some problem to ship it. We have with us Mr. Samuel Pursglove, President of the Pittsburgh Terminal Coal Company. We would be interested to hear from him on this subject.

MR. SAMUEL PURSGLOVE: Mr. President, I haven't much to say. I am certainly pleased to see that that advance in the preparing of coal had been accomplished. I have been working in and around mines in the Pittsburgh district about 48 years, so I can go back to where it was naturally old fashioned. To watch these pictures of Pittsburgh Coal Company-Champion Plant it is a wonderful thing. But the thing that I am personally most interested in is this, after all is it profitable? I have stock in a good many coal companies that I am tired of holding year after year and getting no dividends. That is the thing I am interested in.

PRESIDENT: That is perfectly true. If you put in a dollar and get out ninety cents you are not getting very far. Has any one any questions about this modern cleaning plant that the picture did not show?

MR. C. O. DAMBACH: I would like to have Mr. Queer tell us about his expanding market. We have been interested in his talk on cleaning coal but appreciate this must cost a lot of money and while I am not going to embarrass him by asking

the cost, I will be glad to have him tell us whether his markets have not expanded thus affording additional business to the Pittsburgh territory with the advent of prepared coal.

MR. QUEER: We are putting coal into markets that prior to the advent of the cleaning plants we had no legitimate claim to. Whether we have broadened out sufficiently to justify the expense that is involved in preparing the coal the way we do, is a question almost too broad for me.

MR. MACFARLANE: May I ask Mr. Queer as to the moisture of the coal after it is washed, what is the per cent of moisture in the finished product, approximately?

MR. QUEER: In what size?

MR. MACFARLANE: In your smaller sizes, stoker coal.

MR. QUEER: The inherent moisture of the coal is about 1% to 1.25%. By the use of the hot air blast, there is a series all along the conveyors that carry the coal from the screens to the railroad car, it is possible to put the coal into railroad cars with a moisture content practically no higher than the average of raw coal of the same size. In the finer sizes going through the heat dryer it is an absolute fact that we turn that coal out drier, uniformly drier, than the average moisture in any raw mines we have, of the same size.

The point you bring up is one that has been discussed pretty thoroughly at all points. The fact remains that the subject of moisture is one that very few pople using coal know much about. In the old days it did not matter what it actually was, and if the question was asked of the moisture content the salesman was instructed to say, and did not know any better than to say, about one per cent moisture. Consequently the coal business was more or less under the impression that the coal is about one per cent moisture. Inherently that is about right. But as coal is produced, many mines produce as much water as coal and that water comes in contact with the coal and the coal as it comes from the mine does not carry only inherent moisture. We actually had experience with one man who had specified our coal, and who thought he knew what the moisture content should be and specified 1%. We produced the coal just as dry as it was possible and that was a little better than one per cent. It was just about down to the inherent moisture. The objection we then encountered was the dust. And

it developed that that particular man did not want coal too wet to be handled or dry enough to be dusty. This customer was eventually satisfied with coal that ran about 3%, a little drier than the average of raw coal.

PRESIDENT: Has any of the railroads in this territory in the locomotive game been burning this coal?

MR. QUEER: I heard Mr. Macfarlane say that all their locomotive failures were not caused entirely by the negligence or the carelessness on the part of the coal companies and that he thought the railroad companies should assume part of that responsibility. I have known him a good while and I have never heard him say that before. He also can tell something about the use of some of this mechanically cleaned coal in locomotives.

MR. MACFARLANE: We are using the Pittsburgh Coal Company's washed coal on the Twentieth Century Limited and many other trains. We are using a special size coal on account of these automatic stokers. Some of our coaling stations are not equipped for the separation of the stoker coal and the other sizes. In other words in one coal dock they have to use coal in hand fired locomotives as well as stoker fired. So we struck upon a size for both, a size that would suit both of them. The finer sizes would burn up too quickly in hand fired power so we put in a 4″ size. A piece of 4″ coal will be taken care of by a stoker and yet will not burn as rapidly as the smaller size that we use in regular stoker power. We started running trains through from New York to Chicago with one locomotive without change. We changed the crews about four times on that run of 960 miles, perhaps five times. We used special size coal, 1⅛″ by 2½″ and made 13 round trips on that in the Fall of the year and started on the 14th. Cold weather came on. On the 14th trip they had trouble. In order to avoid paying the excess on those fast trains we cut it out for that particular time, but they will run through from Harmon to Chicago, 960 miles, with one locomotive.

The ash is the big factor in that long run, because we can not dump our ash pans on the road. You can clean the fires but you can not dump the ashes. This fuel works satisfactorily on some long distance runs. At the present time we are running from Harmon to Detroit, 600 miles, with one locomotive without taking that locomotive off the train. That is economy

in operation. The locomotive is working all the time and not standing still. The policy seems to be to run them and wear them out and then get new ones. The through run is an economy in operation.

We have stokers also in freight service but we do not have to have as high grade coal in freight service, due to the fact that the runs are not as long. We take these locomotives off at times every 150 miles in freight service, but others make 300 miles. We find we can get over the road all right with a coal which is not specially refined, though it has to be cleaned.

PRESIDENT: Mr. Berg, have you anything to add?

MR. KARL BERG: I was very much interested in the pictures and in what is going on underground. I had a couple of questions but they were answered by looking at the pictures. One of the questions was, we sometimes get a great accumulation of slack on our tenders in loading same at the coal docks. In all such cases, the coal companies can very promptly advise us just what amount of slack was in the coal when delivered in the cars at the mine. The coal separators, as illustrated on the screen, show just why they are able to give us this information.

I might ask, if proper, regarding the wetting of coal. We, like most other railroads, wet down the coal considerably in the summer time in order to eliminate dust, and this method of wetting the coal sometimes results in a lot of water being thrown on the coal in some places. I would like to know just what restrictions Mr. Queer would recommend for the wetting of coal on tenders and at coal docks, if any.

MR. QUEER: I do not know just how to answer that. Water is used for different purposes. One use is for holding fine sizes together until ignited. Another is to aid combustion. It tends to aid combustion. How much water you should use I cannot say.

MR. JAMES O'TOOLE: One or two of the speakers referred to the necessity of air tight cars being furnished for loading pulverized fuel. I would like to ask if Mr. Queer can give us an idea of what the trend is with regard to this commodity. Is the trend toward increased shipment of pulverized coal direct from mines, or will the increase come from other grades shipped from mines which is pulverized at consuming points?

MR. QUEER: I do not know whether my idea is worth

anything but it seems to me the trend is toward a smaller size coal being shipped from the mines than we are now shipping.

MR. O'TOOLE: The reason that I ask the question is that quite a number of coal shippers are finding fault with the railroads because of their alleged inability, or failure, to supply air tight cars for pulverized fuel and fine slack. If our friend Sam Lynn were here tonight, I think he would tell us that no railroad is in position at all times to supply coal mines with one hundred per cent air tight cars. In other words, if he were frank, and he usually is, I think he would tell us this would be an impossibility with the present types and designs of so-called self-clearing cars used for general service and subject to all kinds of traffic in all kinds of weather, and frequently subject to severe treatment at unloading points, particularly during the winter months. This same proposition has been before the Allegheny Regional Advisory Board for some time, and has been the subject of earnest, joint consideration and study by the Railroad Contact Committee and Coal Committee of that Board, the railroads taking the position that it would be impracticable, if not entirely impossible, to supply general service, self-clearing hoppers, all of which would be water tight at all times. The Coal Committee has suggested that consideration be given to the adoption of a special type car for loading pulverized fuel and fine slack. They have been asked to submit their ideas as to construction and design of such a car. In my opinion, the building of special type cars will not solve the problem. As a matter of fact, our checks show from twenty to thirty per cent of total cars now going to coal mines daily to be water tight, and which, if they could be conserved and allocated, would be ample to protect daily loading of pulverized fuel and fine slack. However, speaking generally, the trouble, as I see it, rests primarily on the lack of sufficient or suitable empty car track capacity at coal mines.

MR. PURSGLOVE: Mr. O'Toole, I would like to answer that because we had a lot of talk in regards to this question. If you send the sieves to haul fine coal in you can expect it to ooze out on the tracks. Of course, it is hard to fix cars to hold 1/4" slack. Everything goes through a 1/4" mesh screen. We are screening now to 3/8" and we want to go to 1/4" as soon as the screening apparatus is in order and we will have to have cars to stand 1/4" fine coal.

MR. O'TOOLE: One other question, Mr. Queer. It is my information your company has solved the problem through the adoption of a new calking material, composed of a mixture of fire clay and pulverized fuel which has stood up in service tests, and has enabled you to get away from complaints reaching you about the danger of fire hazard in stock piles and holds of vessels, as well as complaints regarding clogging of mechanism at industrial points and in stokers of locomotives when hay, straw, etcetera, is used for caulking. Isn't your new method of caulking the answer?

MR. QUEER: At the plant where we make this particular size of coal they ran into this difficulty of being unable to keep it in the cars. After pretty careful survey as to what might be a satisfactory calking material, we found that anything we had to mention was objectionable. As a matter of fact we took it upon ourselves first to use newspapers, not very much, just a few sheets rolled up and packed in the cracks. We had the misfortune with a big pulverized fuel plant to have the paper jam in the pipe and stop the flow. That did not work. It is possible to select tight fitting cars and then by use of a calking material such as was mentioned, a mixture of fire clay and fine coal, the troubles can be pretty largely overcome.

MR. DAMBACH: What percentage of fireclay and what percentage of slack do you have in this preparation you make?

MR. QUEER: I might say that there are many in the organization that object strenuously to the use of that material because the fire clay makes ash in the coal. But the amount of it is so small that it would not appreciably affect the coal. We took considerable time to arrive at a mixtrue to do that calking satisfactorily. We started out with a proportion of 70% coal and 30% fire clay. That did not hold up, so we finally decided on a mixture which I think is 40% fire clay and 60% coal.

MEMBER: I have been wondering to what extent attempts have been made to form briquettes of this fine coal. I understand they do that in Germany. Perhaps that might be the solution of the shipping of this fine coal.

MR. QUEER: I don't know whether I can answer that or not. I think all the coal companies have had more or less the thought of that possibility, not primarily to solve the prob-

lem of shipping fine coal but to increase their realization by putting it in coarse form. There are briquettes being made. A well known process is the Trent. In northwestern Minnesota I believe there are two or three briquetting plants that do a very profitable business. But so far as anything of that nature being done here, I think it is more or less a matter of talk and research and experimental work and nothing definite decided upon.

MR. D. F. CRAWFORD: I think we have had a most unusual paper and one of a great deal of interest to all the railroad people. Of course the coal people are much more familiar with it all than the railroad people. I enjoyed seeing the pictures very much and the glimpse of the underground part of the work gave me a better idea of it than I have ever had. I think the Club should extend a vote of thanks to Mr. Queer for his paper, and I therefore move that a rising vote of thanks be extended to him.

The motion was duly seconded and prevailed by unanimous rising vote.

There being no further business, on motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

W. S. BARTHOLOMEW,
Died, January 6, 1931

J. N. O'MALLEY,
Died, May 21, 1930

BENJAMIN H. RUSH,
Died, December 28, 1930

RESERVED

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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"EVOLUTION OF THE STEAM LOCOMOTIVE"

By A. I. LIPETZ, Consulting Engineer, American Locomotive Company, Schenectady, N. Y., and Non-Resident Professor of Purdue University, Lafayette, Indiana.

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OF

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Organized October 18, 1901

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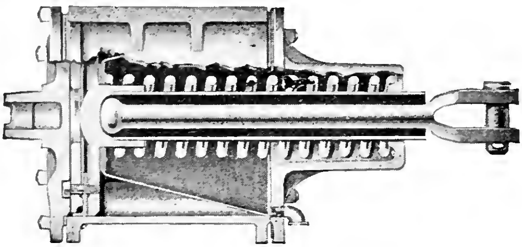

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E. J. DEVANS, General Superintendent, B. R. & P. Ry. Co., Du Bois, Pa.
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Past Presidents

*J. H. McCONNELL	October, 1901, to October, 1903
*L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
†A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
*J. A. SPIELMANN	November, 1918, to October, 1919
H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEO. D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928
W. S. McABEE	November, 1928, to October, 1929
E. W. SMITH	November, 1929, to October, 1930

*—Deceased.
†—Resigned.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
FEBRUARY 26, 1931

The meeting was called to order at the Fort Pitt Hotel at eight o'clock, P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Allen, Harvey
Altsman, W. H.
Ambrose, W. F.
Anderson, G. S.
Anne, George E.
Ashton, William A.
Bair, J. K.
Bald, E. J.
Balzer, C. E.
Beam, E. J.
Bourke, John P.
Bowen, James T.
Brinkhoff, W. H.
Burgham, M. L.
Campbell, J. T.
Carlson, L. E.
Carmack, J. L.
Carson, John
Cassiday, David A.
Christy, F. X.
Cipro, Thomas
Clark, C. C.
Colbert, J. T.
Coombe, A. B.
Courtney, H.
Crawford, D. F.
Crispen, R. B.
Croke, Thomas F.
Cruikshank, J. C.
Dambach, C. O.
Darrall, William G.
Davis, Charles S.
Descamp, J.
Diven, J. B.
Dobson, F. L.
Downes, D. F.
Durkin, James E.
Eagan, D. F.
Edwards, C. H.
Emery, E.
Emsheimer, Louis
En Dean, J. F.
Endsley, Prof. Louis E.
Everstine, A. Perry
Falkner, A. J.
Fry, Lawford H.
Fults, J. H.
Garland, W. L.
Geisler, J. J.
Gerber, H. L.
Glaser, J. P.
Glenn, J. H.
Goda, P. H.
Goodman, O. F.
Grieve, Robert E.
Hackett, C. M.
Hall, Chester C.
Hansen, William C.
Harper, John T.
Hastings, W. S.
Hilstrom, A. V.
Holleran, T. J.
Holmes, E. H.
Hood, J. M.
Hoover, J. W.
Honsberger, G. W.
Hughes, John E.
Irwin, R. D.
Jones, H. W.
Jungbluth, Adolph
Kaup, Earle W.
Kaup, H. E.
Kelly, L. J.
Ketchpel, Paul A.
Kusick, Harry F.
Lanahan, J. S.
Laurent, Joseph A.
Leban, J. L.
Linsenbigler, A. J.
Lobez, P. L.

Lynn, Samuel
Mantell, W. T.
Masterman, T. W.
Meinert, Henry
Meyers, William F.
Millar, C. W.
Miller, Andrew A.
Miller, J.
Misklow, C. J.
Mitchell, W. S.
Molyneaux, Dawes S.
Moore, D. O.
Morgan, Homer C.
Morrison, W. W.
Moyer, Oscar G.
Muir, R. Y.
Myers, B. E.
Myers, W. H.
McCarthy, J. T.
McCoy, James M.
McCully, D. L.
McIntyre, R. C.
McKenzie, Edward F.
McKinley, A. J.
McKinley, John
McLaughlin, H. B.
McMillan, A. P.
McNamee, W.
Nash, R. L.
Neff, John P.
Nelson, W. M.
Nieman, H. L.
O'Leary, J. J.
Orchard, Charles
O'Sullivan, J. J.
Painter, Joseph
Paisley, F. R.
Passmore, H. E.
Pickard, S. B.
Posteraro, S. F.
Pringle, P. V.
Pugh, A. J.
Rauschart, E. A.
Reeve, George
Roth, Philip J.
Rupp, Edwin S.
Rushneck, G. L.
Ryan, D. W.
Ryan, Frank J.
Sample, W. E.
Sanders, George
Sattley, E. C.
Sayre, F. N.
Schaffer, W. E.
Schultz, Charles H.
Seibert, W. L.
Sharp, H. W.
Sharp, James
Shellenbarger, H. M.
Smith, J. Frank
Snitehurst, James G.
Stark, F. H.
Stevens, L. V.
Stevens, R. R.
Thomas, H. N.
Thomas, Theodore
Thompson, F. J.
Tipton, G. M.
Tomasic, N. M., Jr.
Tucker, J. L.
Uline, C. S.
Van Blarcom, W. C.
Van Wormer, Geo. M.
Vollmer, Karl L.
Waldron, F. G.
Walther, G. C.
Warner, Russell H.
Warrensford, Fred S.
Weaver, W. Frank
Wikander, O. R.
Wildin, George W.
Winslow, S. H.
Wheatley, William
Wright, Edward W.
Wyke, J. W.

VISITORS

Adler, John
Allinger, N. J.
Anderson, G. S., Jr.
Baker, W. E.
Bald, H. H.
Barlow, Samuel J.
Barnum, H. M.
Barrett, R. L.
Bigley, Charles
Booth, George
Brandt, B. H.
Cato, Charles H.

Chalmers, J. W.
Christy, Guy C.
Collins, James
Conroy, J. J.
Cook, J. O.
Crawford, E. M.
Davis, David
Dunham, C. W.
Evans, David A.
Evans, Robert E.
Emery, Robert
Emery, John E.
Fisher, C. S.
Follmer, Paul
Gotfried, A. P.
Geisler, William J.
Gollmer, H. C.
Goodwin, Arthur E.
Gray, H. R.
Halberg, E. J.
Harrison, William
Haynes, J. E.
Herbst, F. A.
Holt, James H.
Huston, F. T.
Joyce, P. S.
Kelly, Frank J.
Kentlein, John
King, William R.
Koehler, Edward H.
Kromer, William F.
Lewis, S. B.
Lipetz, A. I.
Martin, T. R.
Masters, Charles
Maxwell, R. H.
Mechling, R. B.
Meider, H. W.
Miller, Charles A.
Mitchell, Paul S.
Morgan, Clyde J.
McClay, William
McGinness, Geo. H.
Obelten, J. C.
Pennington, F. W.
Plank, L. G.
Quast, A. W.
Reeve, F. J.
Rhodes, C. C.
Richards, A. J.
Schmitt, G. A.
Shetland, Arnold C.
Smith, Ewart S.
Smith, Sion B.
Snitehurst, A. W.
Snyder, H. C.
Suffern, R. J.
Thrall, O. B.
Tomlinson, C. E.
Tripp, W. N.
Vollmer, Charles P.
von Bernewitz, M. W.
Weir, G. E.
Wray, W. R.

PRESIDENT: We will dispense with the calling of the roll, as the registration cards give a full record of the attendance.

If there is no objection, we will dispense with the reading of the minutes, as they have been printed and are already in your hands.

We will now have the list of applications for membership:

SECRETARY: The following gentlemen have made application for membership in the Club:

Allinger, Neil J., Assistant Supervisor, Pennsylvania Railroad, 6732 Frankstown Avenue, Pittsburgh, Pa. Recommended by G. S. Anderson.

Anderson, Bert T., Assistant to President, Union Switch & Signal Company, Swissvale, Pa. Recommended by C. O. Dambach.

Deasy, J. F., Vice President, Pennsylvania Railroad, 909 Pennsylvania Station, Pittsburgh, Pa. Recommended by F. L. Dobson.

Dickinson, T. R., Chief Clerk, Purchasing Department, B. & L. E. R. R., 687 Union Trust Building, Pittsburgh, Pa. Recommended by D. E. Reynolds.

Evans, Robert E., General Yard Master, Pennsylvania Railroad, 814 Norwich Street, Pittsburgh, Pa. Recommended by B. E. Myers.

Fagan, N. B., Division Freight Agent, Pennsylvania Railroad, 907 Clark Building, Pittsburgh, Pa. Recommended by F. L. Dobson.

Fisher, J. B., Assistant to General Manager, Pennsylvania Railroad, 1020 Pennsylvania Station, Pittsburgh, Pa. Recommended by C. I. Leiper.

Hannan, Frank A., Real Estate and General Insurance, 1008 Benedum-Trees Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Herbert, T. C., Superintendent, Pennsylvania Railroad, 1013 Penn Avenue, Pittsburgh, Pa. Recommended by F. L. Dobson.

Huston, Frederick T., Master Mechanic, Pan Handle & Wheeling Division, Pennsylvania Railroad, 1013 Penn Avenue, Pittsburgh, Pa. Recommended by F. L. Dobson.

Kirsch, O. W., Assistant Train Master, Pennsylvania Railroad, 1460 Foliage Street, Wilkinsburg, Pa. Recommended by B. E. Myers.

Park, Charles L., Salesman, Goodall Rubber Company, 61 Water Street, Pittsburgh, Pa. Recommended by G. M. Van Wormer.

Parker, William Jr., Assistant Master Mechanic, Pennsylvania Railroad, 7215 Perrysville Avenue, Ben Avon, Pa. Recommended by F. L. Dobson.

Pomeroy, William McL., Freight Traffic Manager, Pennsylvania Railroad, 810 Pennsylvania Station, Pittsburgh, Pa. Recommended by R. H. Miller.

Rill, John C., General Superintendent, Pennsylvania Railroad, 1009 Pennsylvania Station, Pittsburgh, Pa. Recommended by F. L. Dobson.

Ryan, Frank J., District Representative, Detroit, Toledo & Ironton R. R. Co., 1106 Clark Building, Pittsburgh, Pa. Recommended by George R. Gardner.

Snyder, J. C., Manager of Sales, Central District, Standard Steel Car Corporation, 1120 Frick Building, Pittsburgh, Pa. Recommended by C. E. Hood.

Swope, Bruce M., Superintendent Motive Power, Pennsylvania Railroad, 201 Brilliant Avenue, Aspinwall, Pa. Recommended by F. L. Dobson.

White, J. C., Superintendent, Pennsylvania Railroad, 409 Fayette Title & Trust Building, Uniontown, Pa. Recommended by F. L. Dobson.

PRESIDENT: In accordance with our rules, these applications will be submitted to the Executive Committee, and upon approval by them, the gentlemen will become members without further action than the payment of the current dues.

SECRETARY: Since our last meeting we have received word of the death of one of the charter members of this Club, Mr. J. J. Turner, Retired Vice President, Pennsylvania Railroad, which occurred May 29, 1928.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

Is there any further business to come before the Club at this time? If not, we come to the paper of the evening, which is by Mr. A. I. Lipetz, Consulting Engineer, American Locomotive Company, Schenectady, N. Y., who will address the Club on "The Evolution of the Steam Locomotive." I have known Mr. Lipetz for a great many years, having met him away back in 1907 or 1908. At that time I thought he knew a great deal about locomotives and I am sure that by this time he has found out a good many more things. Mr. Lipetz.

"EVOLUTION OF THE STEAM LOCOMOTIVE"

By A. I. LIPETZ, Consulting Engineer, American Locomotive Company, Schenectady, N. Y., and Non-Resident Professor of Purdue University, Lafayette, Indiana.

Mr. Chairman and Gentlemen:—I am going to talk tonight on the evolution of the steam locomotive. It is a very broad topic, on which one could speak for hours, but I do not intend to tax your

patience too much, and am not going to cover the whole subject or to talk more than an hour and a half.

The first thing for a speaker in addressing an audience of this kind is to know the audience. This is a difficult thing for any speaker, and it is particularly difficult for me tonight because I must confess I do not know this audience. I see here Mr. D. F. Crawford, Mr. Lawford H. Fry, and a number of other gentlemen who years ago knew more about locomotives than I ever expect to know, and therefore I am a little apprehensive that I may be telling things which are an old story to them. If I should restrict my topic to something like high pressure locomotives, or some special design of locomotive, it would probably be more interesting to them. But these young gentlemen before me in the front row might not enjoy it. To go along with the average, I think the topic of the evolution of the locomotive, which is a hundred years old, is still an interesting topic to railroad people and their young descendants.

I am going to talk on the evolution of the steam locomotive. I chose this word "evolution" on purpose. I do not say the "development" of the steam locomotive. I suppose every one of us railroad men has a soft spot in his heart for the steam locomotive. We consider the steam locomotive to be an animated being, and it really is a living being to many of us. Our imagination was struck in our youth by the living qualities of a steam locomotive, and that is why a great many of us became locomotive engineers. There is no doubt that the locomotive is the most romantic machine in the world for everybody—layman or expert, a boy or a grown person; we all like locomotives. And when we hear a wheezing and hissing locomotive in the distance, we stop and look around, and follow the gracefully speeding locomotive with our eyes, no matter how many thousands of times we had seen it. That is my attitude and I think that is the attitude of a great many of you. If it is so, then I know my audience.

Years ago, either in this country or abroad, I do not know where it originated, there was a fashion to draw parallels between a steam locomotive and a man. Charts were published on the "Anatomy of the Steam Locomotive," and people were speaking of the physiology of the locomotive. The firebox was compared to the stomach, the boiler to the abdomen, the cylinders to the lungs, the wheels were the legs, etc., etc. We should not draw that parallel too far, of course, but the similarity is striking in many

instances. Even by the fact that in its essential structure the steam locomotive is not much different from the first "true locomotive" of a hundred years ago, the "Rocket" of George Stephenson, one is impressed with the similarity to the comparatively small physical difference between the present day man and the first "true man," the Homo Sapiens. Some people say that because the locomotive has not changed much from the locomotive of Stephenson's time, there is nothing new in it. We have not changed much from the Neanderthal man; we have the same essentials he

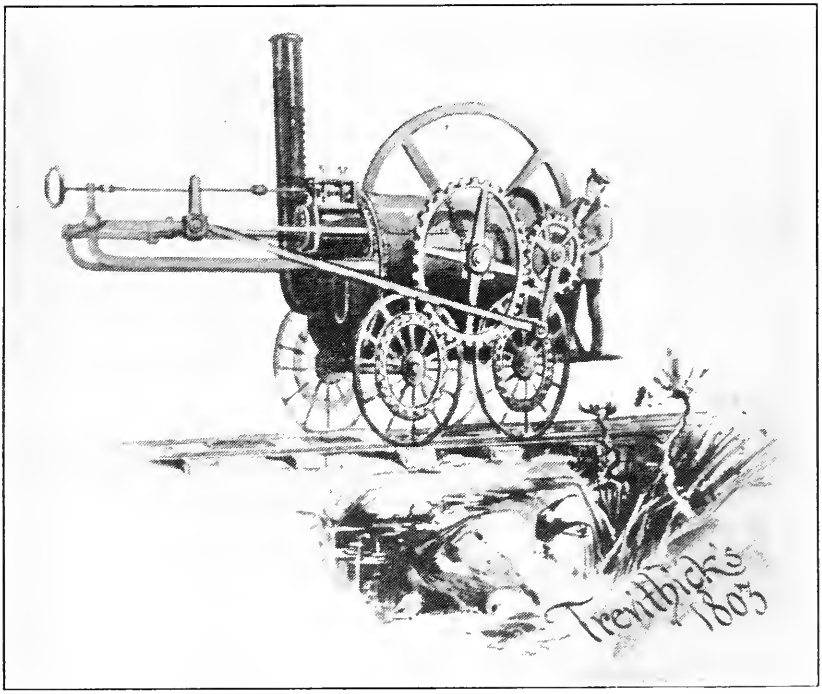

Fig. 1—Trevithick's locomotive of 1804.

had, but we are different. And the steam locomotive of today has the same essentials as Stephenson's "Rocket," but it is different.

We shall not go back to the origin of the locomotive, which is probably as obscure as the origin of man. There are some prehistoric examples which would probably remind one of the Neanderthal man, or other cavemen of the Palaeolitic Age. We shall start with the first locomotive which ran on rails, Trevithick's locomotive of 1804, corresponding probably to the Pithecanthropus Erectus. This locomotive, shown on Fig. 1, had a boiler with a

grate and return flue, a very unproportionate cylinder $8\frac{1}{4}''$ in diameter and 54″ stroke, a long connecting rod, a crank, a fly wheel and a series of cog wheels which drove the wheels of the locomotive. It is claimed that the locomotive had the exhaust pipe directed into the stack, though without a contraction in section. There is positive proof that in a letter of February 20, 1804, Trevithick said "The fire burns much better when the steam goes up the chimney than when the engine is idle." Thus, he had a clear conception of the smokebox draft arrangement of the present locomotive. The Trevithick engine had another feature of the present-day locomotive—namely, the smooth wheels, although it must be said that Trevithick was of the opinion that the wheels outside surfaces should be roughened with bolt heads and other

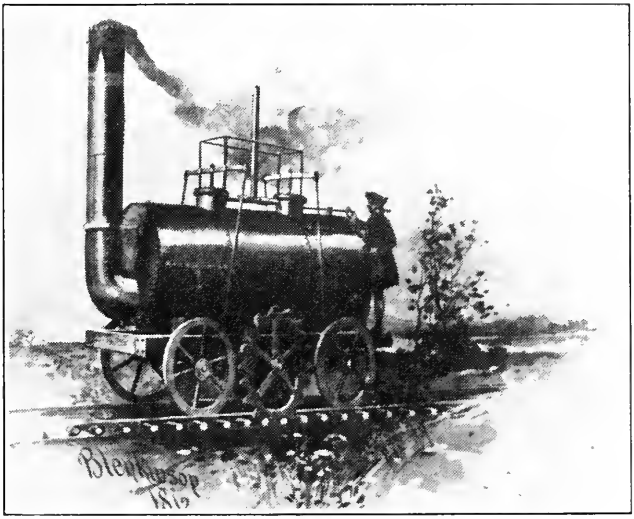

Fig. 2—Blenkinsop's locomotive of 1812.

protuberances to make them hold the rail. There were other locomotives after Trevithick's with more or less smooth wheels, but some designers thought that a cog wheel and a rack were needed for proper traction, for instance, Blenkinsop (Fig. 2). In order to find out whether sufficient adhesion can be obtained with a smooth external surface of the wheels, Hedley in 1813 made a test on a platform on wheels loaded with bars. The wheels were driven by two men on the platform working on cranks connected by gears to the driving wheels. This was the first experimental study ever made of a problem pertaining to locomotives. Hedley stated "I ascertained the proportion between the weight of the

experimental carriage and the coal wagons at that point when the wheels of the carriage would surge or turn around without advancing it," and further he said, "This experiment, which was on a large scale, was decisive of the fact that the friction of the wheels of an engine carriage upon the rails was sufficient to enable it to draw a train of loaded coal wagons." On the basis of this experiment Hedley built in 1813 a locomotive with smooth wheels, known as the "Puffing Billy." It had a very cumbersome driving mechanism and a boiler which carried 50-lb. steam pressure. The engine rested directly on axles without intermediate springs between them.

In 1814 George Stephenson built an engine known as "Blucher," with vertical cylinders, having wheels with roughened surfaces, following Trevithick's idea, but this so wrecked the locomotive as to keep it in repairs most of the time, and smooth wheels were substituted.

Soon afterwards Stephenson built his second locomotive with four wheels and coupled the wheels together by a pair of rods, and in 1825, before leaving the Killingworth Collieries and becoming engineer of the Stockton & Darlington Railway, he introduced for the first time springs in an engine. The Railway was opened on September 27, 1825, with a Stephenson locomotive called "Locomotion." Other locomotives built by Stephenson followed.

Timothy Hackworth was associated with George Stephenson on the Stockton & Darlington Railway, which had a four-cylinder locomotive built by Wilson of Newcastle in 1826. The locomotive was not a success; neither were the other four steam locomotives of the road, built by Stephenson, considered very favorably. The directors of the road were inclined to give up the experiment with steam power and use stationary engines with ropes, but Hackworth induced them to permit him to rebuild the four-cylinder locomotive. In 1827 he converted it into a two-cylinder engine and substituted the cumbersome transmission from the cylinders to the wheels by a direct drive to the pins on the wheels. The most essential change which was made in the locomotive was the turning of the exhaust steam from the cylinders into the smokebox, which had an enormous effect on increasing the steam capacity of the boiler. Incidentally, part of the exhaust was directed into the water tank to heat the feed water. The locomotive was rechristened "Royal George" and was very successful.

During the period when these locomotives were built, Stephenson had been building locomotives in his shops, mainly for collieries and the Stockton & Darlington Railway. All the locomotives were of a different design and some of them, especially the latest of the 18 engines built between 1814 and 1829, had all the good features of the other engines, namely, smooth wheels, direct drive from engine crosshead to pins on the wheels, and the exhaust steam blast. Whether or not the blast pipe had a restriction is not known.

Now we come to that fateful event which shaped the history of the nineteenth century and of our present civilization. In 1829 the Liverpool & Manchester Railway was nearing completion, and some of the directors were still in favor of ropes with stationary engines as locomotive power. They were induced, however, by the rest of the Board to investigate the situation on the Stockton & Darlington Railway and later to offer a prize of £500 for the best Locomotive Engine.

On April 25, 1829, an announcement was published by the directors of the Liverpool & Manchester Railway outlining conditions of a competition for a locomotive. The conditions specified that the locomotive should not weigh more than 6 tons, pull behind it on a level 20 tons, including the tender, at the rate of 10 miles per hour, boiler to carry a pressure not over 50-lb. per sq. in., and consume its own smoke. Five locomotives were presented, but only three actually took part in the competition, which lasted from the 6th to the 14th of October, 1829, and is known in history as the "Rainhill trials." One of the three locomotives was Stephenson's "Rocket;" the other two were Hackworth's "Sans Pareil" and Braithwaite and Erickson's "Novelty." The "Novelty" was very light and graceful. She won the admiration of the public from the first start, when she ran at an unheard of speed of 30 miles an hour. The "Sans Pareil" was heavier and pulled more tons. Each of the two engines, however, failed more than once during the trials and the "Rocket," which had been on the track all the time, won the prize.

The locomotive is shown on Fig. 3, representing actually the replica constructed by Robert Stephenson & Co., Ltd. of Darlington, England, two years ago for Ford's Museum. A very complete and exhaustive study was made by the firm, and the replica is supposed to be the most accurate copy of the "Rocket."

Stephenson's locomotive had the smooth wheels, direct con-

nection of the engine to the pins in the wheels, and the exhaust from the cylinders turned into the smokebox—features which were known and used before, but there was one essential detail in the engine which was new, and that was the multi-tubular boiler with a stayed, square firebox, surrounded by water walls, the boiler which served as a pattern for all locomotive boilers for over a century, and which bears Stephenson's name. This boiler was the heart of the locomotive and the secret of the success of the "Rocket." It enabled it to run at a speed of 29½ miles an hour without load, and at 20 miles with a car containing 36 passengers. When the tender was detached, the engine attained a "terrific" speed for those days, of 33 miles an hour.

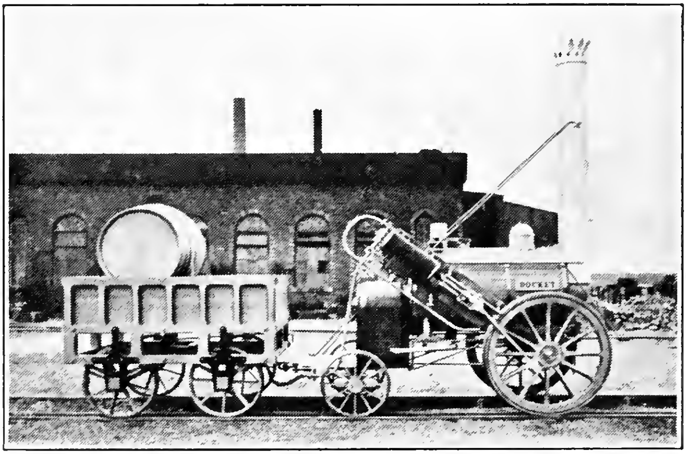

Fig. 3—Stephenson's "Rocket" of 1829.

The multi-tubular boiler itself is not considered to be Stephenson's invention. Nathan Read patented a multi-tubular boiler in the United States long before Stephenson. Seguin in France, the builder of the first railroad from Etienne to Lyons, had a locomotive with a multi-tubular boiler of his own just before the Rainhill Trials. He bought two locomotives from Stephenson, rebuilt them—it is positively known that he rebuilt at least one of the two—which got a multi-tubular boiler with a separate brick firebox. It is even stated that Stephenson's collaborator, Booth, Secretary of the Company, was sent by Stephenson to France to look at Seguin's boiler, which was reputed to be very efficient. Upon his return he and Stephenson built the boiler for the "Rocket." Booth's share in the design must have

been considerable since the judges of the Rainhill Trials divided the £500 prize between Stephenson and Booth.

The great contribution made by Stephenson and Booth as compared with Read and Seguin, lies in the water wall firebox, consisting of two square boxes, one inside the other, the flat surfaces of which are strengthened by stays. This is the form which in its essentials has been retained until the present time.

A great many suggestions to improve the Stephenson firebox have been made and tried, but nothing, even the latest water tube fireboxes in this country, has succeeded in replacing the Stephenson type. The latter has the advantage of simplicity, cheapness of construction, great efficiency by providing a considerable radiating surface, resulting in very rapid evaporation, tending at the same time to cool the combustion gases and protect the tubes from leaking—a disadvantage of the Seguin boiler and of all later attempts to use separate brick fireboxes.

Other features of the "Rocket" are: the frame, which was made of iron bars; the suspension of the boiler, engine and frame on springs, as it has been done in all locomotives ever since; inclined cylinders placed in the rear at an angle of 35°, and the 2-2-0 wheel arrangement with the two large wheels placed in the front.

Neither of the two last features was right and could survive—the inclined cylinders were giving much vibration as a result of the change in the magnitude and direction of the piston thrust component which was taking place twice every revolution. Stephenson must have had a true conception of this feature because he objected to vertical cylinders advocated by Hackworth. As a compromise he made them inclined, but changed them very soon after the Rainhill Trials. In the modification of the "Rocket," as well as in engines of the "Rocket" type built after the Rainhill Trials for the Liverpool & Manchester Railway and in subsequent engines of the Northumbrian type, the cylinders were lowered almost to the horizontal position. In the following "Planet" type, which was destined to become the prototype of a great many locomotives in the world, the cylinders were horizontal, but they were placed inside of the wheels, below the boiler in the smokebox, in order to keep them hot and avoid condensation of steam—this following Trevithick's idea. The cylinders acted on a crank axle and this arrangement remained standard for British locomotives for a long time.

The "Planet" had another innovation as compared with the "Rocket," namely, the small wheels were leading and the large drivers were in the rear. This was an essential improvement over the former practice and in line with modern ideas. It has been followed ever since in all locomotives with wheels of different sizes.

Now let us see what was happening in this country at that time. In the late 20's of the last century several short railroads were built which were operated by horses and mules. In 1826-1827 a three-mile road was built for transportation of granite from quarries of Quincy, Mass., to the Neponset River. Another road, 9 miles long, was used for transportation of Mauch Chunk coal in Pennsylvania from the mines to the Lehigh River. It was completed in 1827.

The Deleware & Hudson Railroad Company, at that time known under the name of the Delaware & Hudson Canal Company, had a short railroad from its mines at Carbondale to Honesdale, Pa., the terminus of the Canal, built in 1828. The year before the Company sent Horatio Allen, then twenty years of age, to England to make an investigation of railroad progress, place a contract for rails, and also for three locomotives.

On February 28, 1827, the Baltimore & Ohio was granted a charter for a railroad and the cornerstone was laid on July 4, 1828, on the anniversary of independence, by Charles Carroll of Carrollton, the last surviving signer of the Declaration of Independence, then upwards 90 years of age. This was the beginning of the Baltimore & Ohio Railroad, which was, strictly speaking, the first railroad of any considerable length designed for the purpose of general passenger and freight traffic. It was also the first railroad on which an American-built steam locomotive made a trip—the "Tom Thumb," on August 25, 1830. Prior to that, however, an English locomotive ran in this country for the first time. The "Stourbridge Lion," built by Stephenson, one of the locomotives ordered by Horatio Allen for the Delaware & Hudson Canal Company, arrived in New York on May 13, 1829. It had a horizontal boiler with a fire tube inside, two vertical, double acting cylinders and walking beams connected by means of rods to crank pins in each driving wheel of the rear axle coupled by side rods to the front wheels. The locomotive was of the 0-4-0 type. It weighed 7 tons instead of 3 as it had been specified.

In August, 1829, the locomotive was completely assembled

and Horatio Allen took it out for several rides near Honesdale, but it could not be used permanently on the road on account of its excessive weight. It was later dismantled and is now preserved at the Smithsonian Institute at Washington.

About that time Peter Cooper, a well-known merchant in New York, started building a locomotive with the help of Johnson and a young apprentice by the name of Milholland. It was the "Tom Thumb" (Fig. 4)—a small locomotive with a vertical boiler approximately 20″ in diameter and 5 ft. high, with vertical tubes made of gun barrels; it had one vertical, double-acting cylinder

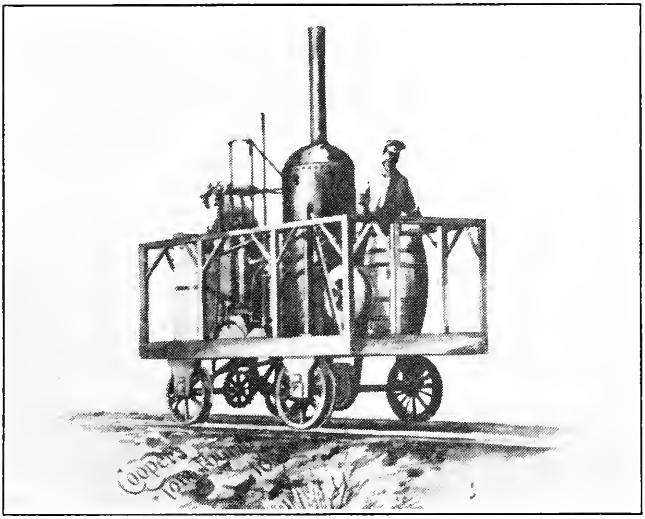

Fig. 4—Cooper's "Tom Thumb."

3½″ bore x 14¼″ stroke, coupled to a crank shaft connected by means of gears to the rear axle. The locomotive was of the 2-2-0 type. The draft was produced by a fan driven from the leading axle. The chassis was that of a small handcar; the whole locomotive weighed about a ton and had an output of several horsepower.

Small as the locomotive was, the consequences were of great importance. On May 22, 1830, the first division of the Baltimore & Ohio Railroad, from Baltimore to Ellicott's Mills, 13 miles long, was opened for transportation and the cars, as the case was on other roads, were moved by horses and mules. On August 28, 1830, a little over ten months after the Rainhill competition, a trial with the "Tom Thumb" was made. The tests were very

successful and evoked great interest among directors of the road. Ross Winans, Assistant Engineer of the Railroad, said on the same day that the experiment with the "Tom Thumb" "established beyond a doubt the practicability of using locomotive steam power on the Baltimore & Ohio Railroad for conveyance of passengers and goods at such speeds and with such safety (when compared with other modes) as will be perfectly satisfactory to all parties concerned, and with such economy as must be highly flattering to the interests of the Company."

On January 5, 1831, an announcement was published in "The American" that the Baltimore & Ohio Railroad would pay $4,000 for a locomotive built in the United States which would draw 15 tons gross weight at 15 miles an hour. The conditions of the competition were stated, and among others, the pressure was stipulated not to exceed 100 lb. per sq. in., which at that time was higher than Stephenson's practice in England.

Five (5) locomotives were built and presented for the competition. All of them were of original design, not affected by the "Rocket" or other precedents, and different from one another. The "York", designed by Phineas Davis and built by Davis and Gardner, won the prize. It was a small 0-4-0 engine with side rods, vertical boiler similar to that of the "Tom Thumb", and two vertical cylinders. The valves were worked by cams; the feed water pump was driven by the crosshead. It is being stated that the exhaust from the steam engine drove the fan which blew the fire. The locomotive weighed 4 tons and was used on the Baltimore & Ohio Railroad in regular service.

The locomotives which followed were known on the road as the "Atlantics". (Fig. 5). The locomotives had the same wheel arrangement as the "York", vertical boiler, two vertical cylinders 10″ x 12″, a jack shaft driven from the cylinders by means of beams, long rods and gears. The rods were attached to the beams at the top of the locomotive and directed towards the rear part of the engine, somewhat resembling grasshoppers' legs. The engines were, therefore, nicknamed "grasshoppers".

Between 1831 and 1837 about twenty locomotives of the "grasshopper" type were placed in service on the Baltimore & Ohio Railroad. Rough riding was the characteristic feature of the type. It was obviously due to the vertical location of the cylinders, and similar to the development in England, this difficulty led to the adoption of horizontal cylinders in the following

type of locomotives. The vertical boiler, jack shaft and the gear and pinion transmission of the "grasshopper" type were retained, but the long rods were abandoned. The locomotives were called "crabs" because they seemed to run backwards.

The combination of horizontal cylinders and vertical boiler, patented by Ross Winans, was inferior to the direct crank drive of British locomotives. The vertical boiler had the advantage that it permitted a short wheelbase for passing curves, but the center of gravity was high and the locomotive was not suited for high

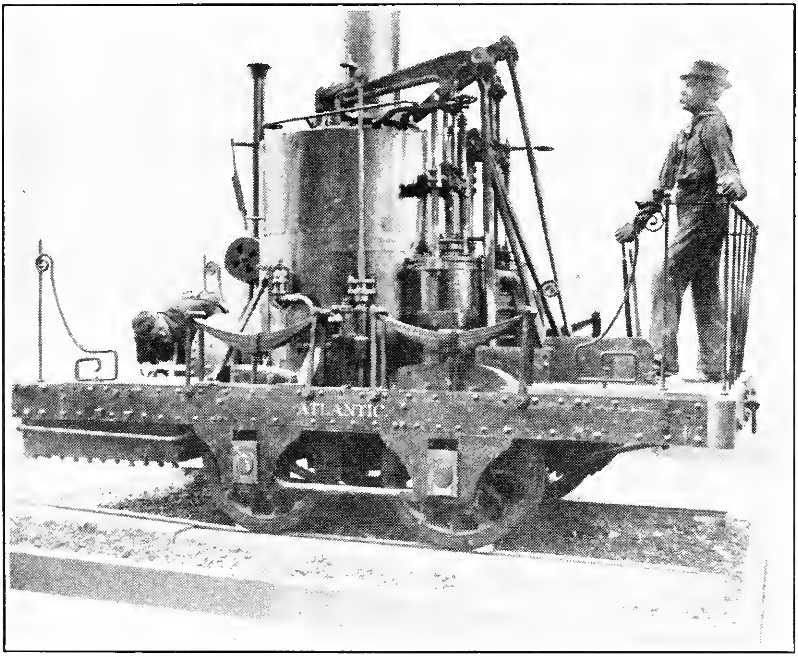

Fig. 5—"Grasshopper."

speeds. Ultimately, the vertical boiler, as well as the complicated gear transmission, disappeared, although it was used for a long time on the Baltimore & Ohio Railroad.

At the time when the Baltimore & Ohio Railroad was developing its types of locomotives, Horatio Allen, who in 1829 was appointed Chief Engineer of the South Carolina road, ordered a locomotive (the "Best Friend") from the West Point Foundry near New York. It had a vertical multi-tubular boiler and inclined cylinders working on a crank inside the frame. The four-coupled wheels were outside of the frame and were connected by

side rods. The locomotive weighed about 5 tons. It was taken by ship to Charleston and placed in service in November, 1830. Another locomotive was soon ordered for the South Carolina Railroad—this time with a horizontal boiler which had a square firebox and six or eight tubes $2\frac{1}{2}''$ or $3''$ in diameter, through which the gases from the firebox passed directly into the lower part of the smoke stack, which served as a smokebox. It was called the "West Point" and placed in service early in 1831.

About the same time the Mohawk & Hudson Railroad, later known as the Albany & Schenectady Railroad, ordered a locomotive from the West Point Foundry to the designs of their engineer, John B. Jervis. It had four wheels, all drivers; two inclined cylinders $5\frac{1}{2}''$ in diameter and $16''$ stroke; a horizontal boiler with a smokebox forming the lower part of the stack, and a rear arrangement very similar to the "Rocket". The boiler carried a pressure of 50 lb. per sq. in., and the locomotive weighed 4 tons. It was called the "DeWitt Clinton", which on August 9, 1831, made the spectacular excursion ride from Albany to Schenectady with a several-car passenger train. It was the first train in the state of New York; it ran on the occasion of the gala opening of the Mohawk & Hudson Railroad and the passengers were legislators, judges and other public officials of that time. The ride was a success except only that instead of anthracite, as it had been previously intended, pitch pine was burned. As the locomotive had no spark arrester and the cars had no roofs, the passengers were exposed to sparks, cinders and parts of half-burned pine. Their garmets caught fire and the crowded train was in a state of panic. Fortunately, by that time, they were near the water tank and the fire was extinguished by drenching their clothes with water. Nevertheless, the performance of the "DeWitt Clinton" itself was very good; at times it attained a speed of 30 miles an hour.

Soon after the opening of the Railroad, a locomotive, "Robert Fulton", was received from England. It was similar to the "Planet" of Stephenson, had two inside cylinders, a crank axle, but all four wheels were drivers instead of the front two being carrying wheels as in the "Planet." The engine was very good as to tractive power and steaming ability, but was very unsteady in riding and was injuring the track. The locomotive frame was 12 ft. long and the wheelbase was only $4\frac{1}{2}$ ft. John B. Jervis recognized that the overhanging weights may be the cause of the

trouble. Besides, the locomotive was very heavy—twice as heavy as the "DeWitt Clinton".

Similar difficulties were experienced with another English locomotive, "John Bull". The locomotive was very heavy for American track, which was rather light in those days. The frames were very rigid and the passing around curves was causing trouble.

The Baltimore & Susquehanna Railroad also had difficulties with an English locomotive, "Herald". Ross Winans, at that time engaged by the Railroad, was trying to overcome the difficulties; so was John B. Jervis on the New York Central. Winans removed the forward pair of wheels on the "Herald" and replaced them by a four-wheel truck as used in passenger cars. Independently, John B. Jervis suggested the use of a truck in a 4-2-0 locomotive ordered in 1831 from the West Point Foundry. It was delivered to the Mohawk & Hudson Railroad and was called, according to some sources, "Brother Jonathan" and to others, "Experiment". It is considered to be the first locomotive in the world equipped with a truck. The riding qualities of the locomotive were excellent and the speed was very high. Statements are being made that the locomotive was frequently making a mile a minute, or 60 miles an hour, and that the builder of the locomotive at West Point, David Matthew, made a trip between the planes of Albany and Schenectady, 14 miles, in 13 minutes, or at a speed of 64 miles an hour.

Following the nice service results with the 4-2-0 locomotive, or independently of it, John B. Jervis rebuilt the "Robert Fulton" into a 4-2-0 engine. Later, in 1833, John B. Jervis ordered from the Stephensons in England a 4-2-0 locomotive for the Schenectady & Saratoga Railroad. The locomotive ("Davy Crockett") was the first engine built in Europe with a truck, or a bogie, as it was called in England.

The introduction of the truck was a great contribution to the locomotive development; it ranks next to Stephenson's boiler. Without the latter, the power of the modern locomotive would not be possible; without the former, the speed of the modern locomotive would not be possible. At that time, the truck was a necessity, because the track on American roads was very weak and it could not support heavy locomotives without distribution of weight on many axles. This was the principal reason for the introduction of the truck. In some cases trucks did not have the swiveling feature having simply supporting wheels, but the Jervis

truck had already a vertical pin. The swiveling truck was patented in 1812 by William Chapman. It seems that the 4-2-0 wheel arrangement was later patented by Crampton, but the fact remains that trucks in locomotives were first used in this country.

The truck met with favor on all sides and was immediately adopted by the two locomotive builders, William Norris and Mathias W. Baldwin. They began manufacturing locomotives in 1832, Mathias Baldwin with his first locomotive "Old Ironsides", which, while it was of Stephenson's "Planet" type and differed very little in construction from the latter, in efficiency and riding qualities was much superior to any of the English locomotives which were brought to this country, like the "John Bull", "Robert Fulton" and the "Herald".

Norris placed the driving axle before the firebox, while Baldwin placed it behind in the same way as Jervis did in the locomotive of 1833 ordered for the Schenectady & Saratoga Railroad.

All railroads began to buy locomotives with trucks and so they were also introduced on the Charleston & South Carolina Railroad, on the Camden & Amboy, The Philadelphia & Columbia, and others. On the Camden & Amboy, Robert L. Stevens, President of the road and son of Col. Stevens, the founder of the Stevens Institute of Technology and pioneer of locomotive propulsion in this country, ordered even a locomotive with a six-wheel truck (6-2-0).

One of Norris' 4-2-0 engines, known as the "George Washington" and built in 1836, pulled, on July 7, 1836, a train of 19,200 lb. with a speed of 15½ miles per hour on the famous Columbia incline on the Philadelphia & Columbia Railroad. That incline was 2800 ft. long and 7.1% steep. The performance of the engine was quite a feat, which was surprising to many a railroad man and locomotive builder, and the "George Washington" established a favorite type for many makers and railroads. The cylinders were 10″ x 18″ and the driving wheels 48″. According to Zerah Colburn, the above performance was quite impossible, unless the boiler pressure was 80 lb. instead of 60 as it was claimed. But even then, it was puzzling how a locomotive with only one pair of drivers, with a weight on them of 8700 lb. out of a 14,930 lb. total weight of the locomotive, could pull this big tonnage. The explanation is that the action of the draft link of the tender, in pulling a big tonnage, results in throwing more weight on the driving wheels, thus increasing the adhesion.

The success of the "George Washington" was overwhelming. Norris got an order for eight locomotives from an English road, Birmingham & Gloucester Railway, which was the first locomotive order placed in this country by an English railroad. The locomotives were to be used on the Lickey incline, which theretofore had always been operated by stationary machines and ropes. The first locomotive delivered by Norris, the "Philadelphia", climbed the grade so easily that Norris was at once given another order for 16 locomotives of the same type. An English locomotive built by Bury failed to accomplish this performance and stopped half way up the incline for lack of steam.

The 4-2-0 locomotives became very popular both in this country and in England, and was the predominant type for some time. Very soon, however, it became too weak. The idea of coupling axles together in order to get more tractive power had been already in use, and even six-coupled engines were built, mainly by the Stephensons in England. Henry R. Campbell of Philadelphia suggested a four-coupled engine with a four-wheel truck in front, and patented it in 1836. It is the known "American" type, which became the most popular locomotive in this country for several decades. Eastwick and Harrison became the builders of locomotives of that type and a great number of them was delivered to the Baltimore & Ohio Railroad.

From 1839 these engines had an innovation, which was another contribution of American ingenuity to locomotive design, and most remarkably, again in the field of improving the running qualities of the locomotive—it is the equalizing lever of Joseph Harrison, Jr., of Philadelphia. In his patent application, Harrison said that the equalizing lever will permit "the two wheels on each side to adapt themselves to the inequalities of the road without altering the relationship to the action of the springs." The first equalizer was applied to a 4-4-0 locomotive called "Hercules", built in 1837.

The equalizing of the suspension springs became an essential part of American locomotives and developed itself into the three-point suspension, which has been standard practice in America ever since. At that time it permitted high speeds on comparatively poor tracks and heavy loads on axles due to the more uniform distribution of weight, thus greatly contributing to the increase in power of the American locomotive.

Among the locomotives built by Eastwick and Harrison, the

most famous were the "Gowan and Marx" for the Philadelphia & Reading Railroad, and the "Mercury" (Fig. 6) for the Baltimore & Ohio. The "Gowan and Marx" had a 5 ft. firebox, 2″ tubes, 5ft. long, and developed remarkable tractive qualities; it hauled from Reading to Philadelphia a train of 104 four-wheel loaded cars at an average speed of about 10 miles per hour. This train weighed 423 tons, or 40 times the weight of the locomotive. The "Mercury" had, for the first time, a single link spring in the leading truck and was famous for its speeds, pulling trains up to a mile a minute. In the first year of its service (1843), the locomotive covered an unprecedented mileage of 37,000 miles.

By that time the standard design of locomotives comprised the horizontal boiler, horizontal cylinders and direct drive to wheels.

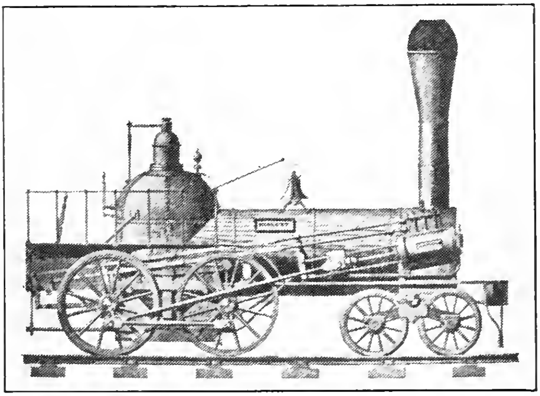

Fig. 6—B. & O. "Mercury."

The Baltimore & Ohio, however, persisted in continuing their peculiar designs, and having given up the vertical boiler and vertical cylinder features, stuck nevertheless, to the indirect drive with a jack shaft. Ross Winans built in 1844 a heavy eight-coupled locomotive, the "Buffalo", with horizontal cylinders driving a jack shaft placed above the rear coupled axle and geared to it. As their predecessors, the "grasshoppers" and "crabs", these locomotives, a number of which was built between 1844 and 1846, were nicknamed "mud diggers" for the reason that they pounded up very much dust from the light track. However, this type was soon abandoned in favor of the conventional eight-coupled locomotive with horizontal cylinders and direct drive—the ordinary 0-8-0 type. One peculiarity, however, was still retained by the Company in providing their engines with cabs placed on the top of boiler, into

which the engine driver had to climb on the side of a sloped firebox. The engines were known as the "camel backs" (Fig. 7). With the disappearance of these locomotives early in the 60's, the locomotives all over this country acquired their standard shape.

A great influence on the design of the American locomotive was exerted by Thomas Rogers of Paterson, N. J., who started locomotive building in 1835, and William Mason & Company of Taunton, Mass. Rogers was the first to use in locomotives four fixed eccentrics and counterbalances in wheels. Both improvements were made in the "Sandusky" built in 1835. Later he introduced the Stephenson link motion as standard practice and was among the first to balance the reciprocating weights by revolving

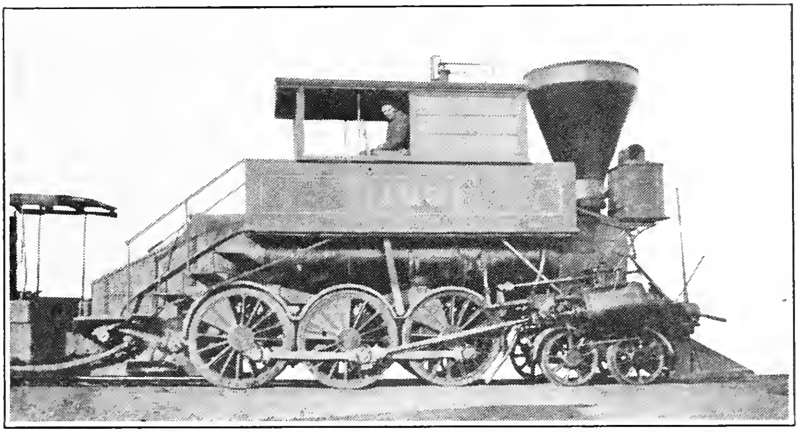

Fig. 7—"Camel Back."

counterbalances in the wheels. Mason was also one of the first to build locomotives with link motion, and as a matter of fact, he even tried the Walschaert gear, which was not received very favorably by the engineers of those days for the reason that they could not change the lead. Forty years later, however, the Walschaert gear became standard in this country.

Mason also introduced the round smokebox seat on a cylinder saddle. Before him, the cylinders had been bolted to the smokebox and to the frames in various different ways. The smokebox was too weak, even when strengthened by crossties; the cylinders were attached to the saddle. Later he divided the saddle in two and cast each half integral with each cylinder. This design has been retained since Mason's time—1856—up to the present.

Rogers and Mason also evolved the placing of cylinders in a horizontal position between the wheels of a truck, thus lengthening the truck wheelbase in order to obtain sufficient room for them. Up to that time it was customary to place the truck wheels very close to each other, making the truck wheelbase very short. This change contributed enormously to the graceful appearance of the engine, for which the Mason locomotives were famous. They

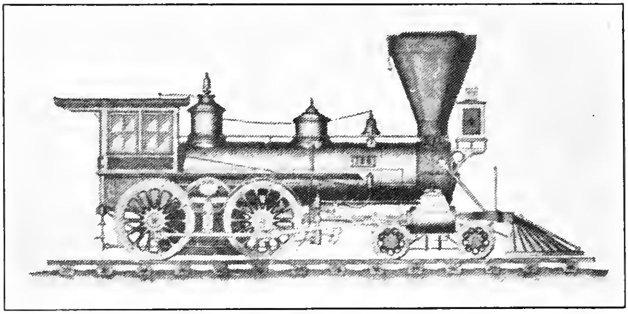

Fig. 8—Mason's "Enterprise" of 1855.

were considered the neatest, the best proportioned engines of the time and were known for their good workmanship. His "Enterprise" of 1855 (Fig. 8) is a very good example of a graceful American locomotive.

With the introduction of the pony truck patented by Bissel in 1857 and of the feed water injector invented by Giffard in 1859, the first period of the evolution of the locomotive, which can be called the Period of Search, comes to a conclusion. The second period is that of perfection and growth.

Note: (In the second part of his talk Mr. Lipetz reviewed the increase in efficiency of the locomotive due to the use of higher pressures, temperatures, system of compounding, superheating, improvements in valve motions, better counterbalancing and the use of economy devices. He also traced the increase in power due to the use of heavier rails and more weight on drivers, the increase in number of coupled wheels, and the employment of the articulated types of locomotives. He described the latest high pressure locomotives used on the Delaware & Hudson, on German, French and English railroads, as well as the two multi-pressure locomotives now being built for the New York Central and by the Canadian Pacific.

This talk was illustrated by a great number of slides showing the latest modern locomotives in this country and abroad).

PRESIDENT: I am sure we have all been brought right up-to-date on what is being done in the locomotive line and have had some history given us that we did not all know about before. I am thinking some of you may have a few questions you would like to ask the speaker before he leaves.

MR. J. H. GLENN: I would like to ask, with the high degree of superheat, 800 to 900 degrees, just how the cylinders are lubricated and what kind of lubricant is used?

MR. LIPETZ: I have not had much experience with high temperatures. The German locomotive of which I spoke, with 1700 pounds pressure, had steam superheated to 800 degrees F. The temperature would go up occasionally to 900 degrees, but regularly the temperature was about 800 degrees. I do not know what their experience was. I saw in Europe a stationary engine with a boiler of the same Loeffler type which was running for more than two years with temperatures up to 900 degrees F. They did not use anything else but high grade oil imported from America and recommended for that temperature.

In this country we have not been using on locomotives temperatures as high as 800 degrees although, I understand, on stationary installations, presumably with turbines, higher temperatures are experimented with. On locomotives we do not go higher than 750 degrees F. and we have no difficulty in lubricating at this temperature.

MR. WILLIAM F. KROMER: What kind of steel is used in these high temperatures?

MR. LIPETZ: In some boilers of the conventional type where the pressure is above 250 pounds, as well as in the Delaware & Hudson engines, alloy (nickel or silico-manganese) steel is used. All essential parts in the Schmidt multipressure foreign locomotives are made of nickel steel. In the locomotives of the same type built for the New York Central and C. P. R. tubes are made of ordinary carbon steel, but the drums and the firebox ring are made of low carbon nickel steel with 2½% nickel. The low pressure boiler which carries 250 pounds pressure is made of nickel steel simply for the purpose of reducing weight. As regards tubes, we have considered all kinds of material and finally decided to use low carbon steel.

MR. H. E. PASSMORE: I would like to ask what diffi-

culty, if any, was experienced in counterbalancing the locomotives with high pressure as against a low pressure, and to what degree do they counterbalance an engine? How close can you put the balance? Is there any, and if so approximately how much, hammer blow?

MR. LIPETZ: Counterbalancing the multipressure high pressure locomotive was rather an easier problem than that of an ordinary locomotive because the parts were lighter on account of smaller dimensions. We use the three cylinder arrangement; the French locomotive has four cylinders, so it simplifies the counterbalancing.

MR. PASSMORE: The two cylinder arrangement in particular?

MR. LIPETZ: There was no particular difficulty on the two cylinder engines of the Delaware & Hudson Railroad. All three locomotives are of the consolidated type (2-8-0) and the first two "Horatio Allen" and "John B. Lewis" have small wheels, 57″. We had some difficulty in counterbalancing these two locomotives but this was not due to the high pressure feature. On the third engine "James Archibald" the wheels are larger, 63″, and the problem is not so hard. As a matter of fact, this locomotive has a very good counterbalancing.

MR. S. H. WINSLOW: I would like to ask what plans are being made to build condensing locomotives, not high pressure but condensing and using the water over?

MR. LIPETZ: Out of seven locomotives with condensers which have been built within the last eight years only one or two are really successful. I do not know of any new condensing locomotives being contemplated.

MR. D. F. CRAWFORD: It is not often that we have a hundred years of history rolled into a little over an hour. We have had that opportunity this evening, and as I have studied the history of the locomotive quite considerably it has been extremely interesting to me and I feel that it has been very interesting to the members of the Club. I therefore would move a rising vote of thanks be tendered to the speaker of the evening as an expression of our appreciation.

Motion prevailed by unanimous rising vote. There being no further business, on motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

J. J. TURNER

DIED MAY 29, 1928

RESERVED

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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Vol. XXX MARCH 26, 1931 No. 5

"PRESENT DAY TRANSPORTATION"

By MR. M. J. GORMLEY, Executive Vice-President,
American Railway Association, Washington, D. C.

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OF

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Organized October 18, 1901

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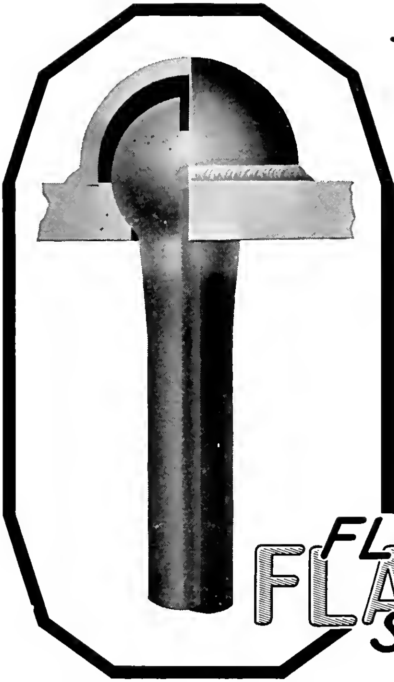

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OFFICIAL PROCEEDINGS
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Meetings held fourth Thursday of each month except June, Ju'y and August.

PROCEEDINGS OF MEETING

MARCH 26th, 1931

The meeting was called to order at the Fort Pitt Hotel at 8 o'clock p. m., with Vice-President J. E. Hughes in the chair, President Endsley being absent on account of a death in his family.

The following gentlemen registered:

MEMBERS

Allen, Harvey
Allinger, N. J.
Altsman, W. H.
Askin, J. A.
Babock, F. H.
Ball, Fred M.
Berg, Karl
Bowen, James T.
Buffington, W. P.
Burel, W. C.
Campbell, J. E.
Campbell, J. T.
Cannon, T. E.
Carson, John
Christy, F. X.
Clark, C. C.
Conway, J. D.
Cotter, G. L.
Courtney, H.
Crawford, D. F.
Croke, Thomas F.
Dambach, C. O.
Davis, Charles S.
Devans, E. J.
Diven, J. B.
Downes, D. F.
Dunbar, H. F.
Durkin, James E.
Edwards, C. H.
Emery, E.
Emsheimer, Louis
En Dean, J. T.
Erickson, L. S.
Evans, Robert E.
Everstine, A. Perry
Falkner, A. J.
Fenton, H. H.
Fletcher, A.
Follett, W. F.
Forsberg, R. P.
Frauenheim, A. M.
Fults, J. H.
Furch, George J.
Gardner, George R.
Geisler, Joseph J.
Gilg, Henry F.
Glaser, J. P.
Goda, P. H.
Gordon, G. A.
Gorman, Charles
Hall, Chester C.
Haller, C. T.
Haller, Nelson M.
Harper, G. C.
Hastings, W. S.
Holmes, E. H.
Hood, C. E.
Hoover, J. W.
Hughes, J. E.
Huston, F. T.
Jones, H. W.
Kelly, L. J.
Kiefer, Fred
Kirk, W. B.
Kirkpatrick, R. L.
Kroske, J. F.
Kummer, Joseph H.
Lanahan, Frank J.
Laurent, Joseph A.
Leban, J. L.
Lobez, P. L.
Loeffler, George O.
Longdon, Clyde V.
Lowry, William F., Jr.
Ludgate, B. A.
Lynn, Samuel

Mayer, L. I.
Meinert, Henry
Mertz, G. H.
Miller, J.
Miller, L. L.
Mills, C. C.
Misklow, C. J.
Misner, G. W.
Morgan, A. L.
Morgan, Homer C.
Moore, D. O.
Moses, G. L.
Moyer, Oscar G. A.
McAbee, W. S.
McCrea, J. G.
McCully, D. L.
McIntyre, R. C.
McKenzie, Edward F.
McKinley, A. J.
McKinley, John T.
McLaughlin, H. B.
Nagel, James
Nash, R. L.
Nelson, W. M.
Norris, J. L.
O'Leary, J. J.
Orchard, Charles
O'Toole, J. L.
Palmer, E. A.
Pringle, P. V.
Posteraro, S. F.
Ralston, J. A.
Rauschart, E. A.
Reeve, George
Reifsnyder, J. A.
Richardson, H. R.
Ryan, Frank J.
Saltic, Thomas
Sample, W. E.
Sattley, E. C.
Sayre, F. N.
Seiss, William C.
Seroky, Edward A.
Severn, A. B.
Schaffer, W. E.
Shannon, David E.
Sheets, H. E.
Shellenbarger, H. M.
Smith, H. K.
Smith, R. W.
Snyder, F. I.
Stevens, L. V.
Stevens, R. R.
Stucki, A.
Sutlerland, Lloyd
Thomas, H. N.
Thomas, Theodore
Tipton, G. M.
Trautman, Harry J.
Van Horn, I. L.
Van Wormer, G. M.
Warner, R. H.
Weston, A. P.
Wheatley, William
Wikander, O. R.
Williamson, A. G.
Winslow, S. H.
Woodward, R.
Wright, Edward W.
Wright, John B.
Wynne, F. E.

VISITORS

Adler, John
Andrews, R. J.
Baker, W. E.
Bobanick, F. A.
Brooks, Charles
Branagan, J. P.
Canon, B. H.
Caruthers, G. R.
Cook, W. G.
Edge, G. H.
Elliott, Norman
Emsheimer, M.
Friend, E. F.
Gatfield, A. P.
Geisler, Joseph A.
Gelston, George A.
Gormley, M. J.
Hults, L. G.
Knouse, A. T.
Kreidler, L. H.
Lewis, S. B.
Lois, G. James

Main, Robert	Ramsey, J. P.
Millard, W. H.	Smith, Robert B.
Miller, T. N.	Smith, Sion B.
Mock, J. E.	Snyder, H. C.
Mullooly, C. J.	Westwood, G. T.
McFarren, Maurice	Winslow, George W.
McGarry, W. J.	Wolcott, C. F.
McMaster, Robert	Woods, G. M.
Oldler, J. C.	Wright, E. W., Jr.
Parks, H. E.	Yorke, P. H.

Young, W. K.

The calling of the roll was dispensed with as a complete record is afforded on the registration cards.

By common consent the reading of the minutes of the last meeting was dispensed with, and the Proceedings have already been published.

The Secretary read the following list of proposals for membership:

Davis, John W., General Manager, Penn Iron & Steel Company, Creighton, Pa. Recommended by Charles J. Nieman.

Morris, A. T., General Manager, American Chain Company, Braddock, Pa. Recommended by Charles J. Nieman.

Peabody, Reuben T., Railroad Sales Assistant, Air Reduction Sales Company, 60 East 42nd street, New York, N. Y. Recommended by J. A. Warfel.

Sullivan, P. W., Superintendent, Eastern Division, Pennsylvania Railroad, 506 Pennsylvania Station, Pittsburgh, Pa. Recommended by F. L. Dobson.

Uhar, John J., Auditor, Penn Iron & Steel Company, Creighton, Pa. Recommended by E. A. Rauschart.

Winslow, George, Manager, Ingersoll-Rand Company, 706 Chamber of Commerce Building, Pittsburgh, Pa. Recommended by E. A. Rauschart.

CHAIRMAN: These applications will be referred to the Executive Committee in accordance with the provisions of our By-laws, and upon approval by them the gentlemen will become members without further action of the Club.

Is there any further business to come before the Club at this time? If not, we will proceed to the address of the evening on

the subject "Present Day Transportation." And it gives me pleasure to introduce the speaker, who will address us, Mr. M. J. Gormley.

"PRESENT DAY TRANSPORTATION"

By MR. M. J. GORMLEY, Executive Vice-President, American Railway Association, Washington, D. C.

I always feel honored when called upon to address an aggregation of this kind, but proceed with caution, realizing that in such a group are some "old timers" like myself, and if I get out of line I am liable to be "called."

While the subject is "Present Day Transportation," we have to consider a little railroad history of the past few years and bring it up to the present to get a proper understanding. It is necessary to inflict a few figures on you, because it is impossible to explain the current situation without them.

There has been an increase in miles per train hour, a term I prefer to "miles per car per day." While "miles per car per day" is an indication of the movement of equipment, there is some distortion when 600,000 surplus cars are charged against it. "Miles per train hour" represents the time made by the cars while in transit. It is now running 14.4 miles per hour, which is an increase of 32% over the year 1923, equal to an increase of 84 miles per day, and is one of the reasons for the large surplus of cars, the other reason being the decrease in business. Including surplus cars, and cars undergoing and awaiting repairs, gives a fair average of 36.3 miles per day.

You will perhaps remember when the Railway Executives met in New York in 1923 they set a mark to shoot at the figure of 30 miles per car per day. Many people thought that mark could never be reached. But we have gone away beyond it. One of the reasons for this increase in miles per car per day is that we have better equipment than in the early year after the War. The railroads have put into service since January, 1923, 883,363 freight cars, but they now own 111,481 less than they did, not counting refrigerator cars. There has been an increase in refrigerator cars due entirely to the increase in the transportation of fruit and vegetables. 16,330 locomotives were placed in service during that period and they now own 9,135 less than they started with. Our latest figure on surplus cars is 642,997 and on locomotives 9,808. Part of the surplus in locomotives and cars is due to the 32% increase in efficiency previously referred to.

What brought it about? You have all heard about the billion dollars a year expended since 1923 by the railroads. This is a big figure and hard to understand. It runs a little less than a billion a year for every year since 1923. Part of the money was spent for nearly a million new cars and 17,000 locomotives. When the railroads are buying, everybody is buying. When the railroads are not buying we cannot expect to have a prosperous Country. Without prosperous railroads we need never look for any very great prosperity.

I have been asked a good many times what I think about business for the balance of the year. Keeping in mind again the buying power of the railroads and the 643,000 surplus cars, which includes 22,160 condemned but not retired—(their retirement would play havoc with the balance sheet, so their final retirement is temporarily deferred) I do not mean that there is not an opportunity for the railroads to continue to spend money as they have in the past, for when I see 160,000 cars with an average age of 22 years, I know, and you know, that we would be better off if the situation of the railroads was such as to permit of the retirement of these cars and replace them with 50,000 new, modern high-capacity cars. In other words, 50,000 of the new modern cars would much better do the work of 160,000 old and obsolete ones.

I made the statement in 1927 that the business of this Country could be handled with 100,000 less freight cars than were then owned, and that was before efficiency had been brought up to what it is now. I am now prepared to state that we ought to make that 150,000 additional or 250,000 less than then owned.

That need not frighten the car builders because it can only be accomplished by the retirement of cars that are expensive to maintain and a contributory cause of accidents. And they are being rapidly retired.

Those of you who deal directly with the railroads, see a nice, new, locomotive pulling out. You look at it. It is a fine engine; it pulls a long train. After a while another one comes along, one of the old ones. The old one is going to cost more before it goes through the shop. What we would like to do is to retire that engine, but we must have money to do it and we have to know whether we can make a return on that investment. Did the railroads make a return on the investment in those 883,000 cars and 16,000 locomotives? There was not a carrier in this Country

that would have earned one dollar of net money in 1929 had it not been for the economies effected in their operating expenses since 1920. In 1929, with a tonnage greatly in excess of 1920, there was a decrease in operating expenses of $1,324,000,000. In 1929, with a heavier business than was handled in 1923, a reduction in operating expenses of $600,000 under 1923 was made. When we can save that much, we should continue to spend money for cars if we can continue to make the same return on the investment. When that time will come, is anybody's guess.

There has been a lot said about the railroads being backward in putting in new improvements. I want to read you an excerpt from address made by Ralph B. Wilson, Vice-President of the Babson Statistical Organization, before the Springfield Traffic Club on March 18, 1931:

> "Railway Efficiency: There is no phase of business or commercial activity in the United States today that is carried on with greater efficiency and with greater consideration of the public welfare than our railroads. The evidence of that efficiency can be found in the fact that the operating ratio of the railroads in the United States has declined from ninety-four per cent in 1920 to less than seventy-two per cent in 1929. Even under the depression of 1930 the operating ratio was only seventy-four and three-tenths per cent. It would be quite difficult to illustrate such efficiency of operation in any other known business activity in the Country."

That is mentioned merely to show that the railroads have done a great deal to effect improvements that result in reduced operating expenses, and while there will not be as great an opportunity in the next six years as in the last, I do believe if we eliminate another 150,000 cars it will go a long way in further reductions. This reduction of 250,000 cars is not proposed as result of the material decrease in traffic now being suffered because of the present depression. With a 32% increase in efficiency it is not an extravagant statement to say that with the elimination of 250,000 cars the railroads can handle as much, if not more, traffic than was transported in 1929, which is the peak of all time from the standpoint of tonage handled.

Now we come to the present situation, the bus, truck and water competition. It is a comprehensive subject and no attempt will be made to discuss all its features.

The railroads are accused by the proponents of waterway development of trying to obstruct progress and interfere with work in this direction. No one ever heard a railroad man make such a proposition. They may have voiced objection to the Government spending money for any waterway that can be shown to be an uneconomical venture, such as development of the Missouri River for movement of 199,000 tons, 197,000 of which would be material for improving the River, the other 2,000 being floated logs. Improvement of the Missouri River at Kansas City and Sioux City was an expenditure of the taxpayers' money for a will-o-the-wisp. I worked for a railroad whose line crossed that River. $100,000 was spent trying to keep the River under the railroad bridge. If it cannot be kept under a bridge how can a nine-foot channel be kept in it? But $15,000,000 have been appropriated for it, and will be spent.

The Government is in the waterway business, which means the Government is competing with other forms of transportation operated with private capital. But in addition the railroads are forced to partly subsidize their waterway competitor. For example: A shipment going to New Orleans formerly moved over the Pennsylvania and the Illinois Central. There is a certain division of the rate. The Pennsylvania Railroad now delivers that same shipment to the Barge Line. Will the Barge Line accept the same division of the rate that the Illinois Central did? No, the railroads must absorb part of it. Part of that reduction is "hung" on the Pennsylvania Railroad.

There is a barge line operating from Dubuque to Minneapolis. Shipments by railroad from Chicago to Minneapolis are unloaded at Dubuque and placed on the barge after which the car is taken empty to Minneapolis for flour loading. Can any one see economy in that method of transportation?

The rail-and-water rate is supposed to be 20% cheaper than the railroad rate, but the railroad in some cases is required to assume 55% of the reduction in the all-rail rate. These facts cannot be disproved. We maintain the Government has no business engaging in transportation.

Bus and truck competition is a long story. I have here a pamphlet entitled "Rails and Roads." This is the statement presented to the Interstate Commerce Commission by Colonel Alfred P. Thom, General Counsel of the Association of Railway Executives; Dr. C. S. Duncan, Economist of the Association; and Mr.

R. N. Collyer, Chairman of the Traffic Executives Association, on the regulation of buses and trucks. I will quote a little of it. Upon application to your Secretary a copy will be sent to any who may wish it. We think it is a fair presentation of the subject. It should be studied by everyone interested in transportation.

"The Railway Executives believe:

"1. That regulation should extend to passenger common carriers and charter buses (but not to taxicabs, school buses or hotel buses), and to common carrier and contract motor carrier trucks operating on the highways for compensation or hire, but do not at this time recommend that it be applied to owner-operated trucks operated solely in the business of the owner.

"2. That such regulated motor carriers should be required to obtain from the Interstate Commerce Commission certificates of convenience and necessity and that in determining on the issue of such certificates the Commission should give proper consideration to—

> (a) The quality and permanence of the service to be offered by the applicant;
>
> (b) Existing transportation service, requiring that a showing be made, satisfactory to the Commission, of the necessity for and convenience to the public of the proposed operation;
>
> (c) The financial responsibility of the applicant, including adequate provision for surety, or insurance, for the protection of the public.

"3. That (a) an applicant to whom a certificate of convenience and necessity is granted by the Commission should be required to comply with all the conditions in each State that duly authorized State authorities impose upon intrastate operations on its highways;

> (b) proper accounts, in forms prescribed by the Commission, should be kept and reports be periodially made;
>
> (c) adequate requirement should be imposed to secure just and reasonable rates, both maximum and minimum, with provision for the publication thereof and adherence thereto and proper inhibition against undue and unjust discrimination.

"4. That opportunity should be given for rail carriers to engage in such motor vehicle service on the highways on equal terms with others and without discrimination in favor of, or against, other transportation agencies in the same field."

I heard Mr. J. J. Pelley, President of the New York, New Haven & Hartford Railroad, make a statement that exemplifies the necessity for regulation in the interest of permanent stability of bus and truck operation. The New Haven Railroad operates more buses than any other railroad in the Country and possibly any other bus company. There are eight bus lines between New York and Boston, three owned by the New Haven Railroad. Finally they heard that a ninth was going to come in and cut the fare from $4.00 to $3.00. Mr. Pelley called for his bus man and said "You go over and tell him if he has something better in the line of a bus or terminals, all right, come on in, but don't cut the rate to $3.00. If he insists on cutting the rate to $3.00, you go to $2.50. If he goes to $2.50 you go to $2.00. If he goes to $2.00 you go to $1.50. If he goes to $1.50 you go to $1.00. If he goes to $1.00 you go to 50c. If you find out he is going to 50c you come back and see me before we start to paying people to ride with us."

That sort of competition is never going to establish permanent transportation by buses, or permit buses to find their proper place in the transportation field. There are a great many services for which both trucks and buses are fitted that cannot be furnished by the railroads except by the same means of transportation. It is not always a matter of cost, it is sometimes a question of convenience. We have heard a great deal about store-door-delivery as one of the functions of the railroads. I was in Canada a short time ago meeting with Canadian National officers and listened to a discussion on the question of loss of traffic to trucks. I happened to know they had maintained store-door-delivery at Montreal and Toronto for years, but they lost the business to trucks between those places. So it is not always a question of whether or not store-door-delivery service is available.

How can the contract carrier be covered? One of the lawyers at the hearing last week made the statement: "I am a shipper in Boston. Don't you think I have a right to contract with a truck company to haul my freight at a price which we may agree upon that is not published?" Colonel Thom made the answer, "That is what the railroads used to do years ago. To a big shipper,

who had a nice juicy bunch of tonnage to move, we would say: 'Give it to me.' He would ask: 'At what rate?' 'At the published rate and I will see you later.'" Later he handed him over the rebate. The shippers did not like that. The same thing is true of trucks. There is no reason why one man should have a rate lower than another. That will never stabilize truck transportation.

Incidentally, added to it is the subject of land grants. In here (referring to the pamphlet) are some statements made by Congressmen at the time lands were granted to the railroads. At that time some of the land could not be disposed of at 12½ cents an acre. After the land was made available to the railroads, the alternate sections which the Government retained had a sale value of $2.50 an acre. Furthermore the railroads have been required to give reduced rates during the years since 1876 on all traffic they have handled for the Government.

(At this point, Mr. Gormley volunteered to answer questions from those present).

MR. FRANK J. LANAHAN: Early in the evening the effective pipe lines on railroads was mentioned. As this is a much discussed topic and its application to existing transportation is little understood, enlightenment on this subject through you, would be beneficial.

MR. GORMLEY: The only thing the railroads have said about pipe-line transportation is that they believe a common carrier by pipe-line should be subject to the same regulation as a railroad. A railroad cannot handle material in which it has a financial interest. In the old days they used to do a lot of things with coal. A stop has been put to that. The pipe-line owner now can transport his own oil with a common carrier pipe-line. If the railroads attempted to go into the pipe-line business (and that has been talked of) they would be barred from doing it because the only practical way to handle it is to buy it and ship it yourself. There isn't such a thing as a common carrier pipe-line, as I understand it. If the railroads went into it they would have to buy the oil, and when they transported it they would be transporting material owned by themselves.

About all we have a monopoly of now is "regulation" and we would like to get rid of it. When regulation was tied to us we were a monopoly of transportation.

Today the truck man frequently finds out what the railroad rate is, cuts it 10 or 20 per cent, picks the consignment up at shipper's door and delivers it to the consignee's door. But if offered bulky shipments that do not weigh much, he objects because they take up too much space. "Give that stuff to the railroads and give me the material that loads heavy." Remember, railroads must continue to be the principal means of transportation. Anybody who advances the idea that any other method of transportation can move the traffic of the basic industries of this country does not know what he is talking about.

In this pamphlet is an interesting statement made by Colonel Brainerd Taylor, Quartermaster Corps, War Department, which Colonel Thom used:

> "The fundamental basis of a national system of transportation in the United States, upon which a national transportation policy and all transportation laws and regulations should be based is obviously an arterial system of railways with due regard to the relation of terminal area operations to trunk-line operations and to the coordination of rail, water, air and highway transportation."

He was talking from an army standpoint.

How are we going to bring about coordination when nobody knows what the rates are. Stabilization of the industry is necessary before any one can predict what its proper place will be.

The statement that the railroads are trying to drive the bus lines off the highways is absurd and not one thing can be found in statements made by anybody in the railroad business saying that is what the rail carriers are attempting to do. The railroads know it is a means of transportation which is here to stay. The same is true of pipe-lines. But many railroads cannot go into the truck business directly, on account of charter provisions. They have to enter through subsidiaries.

I am not a pessimist about the future. "Necessity is the mother of invention." It sometimes takes adversity to bring about improvement. Personally, I think the present day depression will prove to have been a good thing for a lot of people, including the railroads. If the elimination of old equipment can be brought about (and it will cost a lot of money to do it) they will eventually bring their costs down where, at least on long-haul transportation, it will be impossible for any other means to compete with it. I do not believe they are sunk. They are still a living outfit and

when they are irritated they are going to do a better job of cleaning.

MR. E. F. McKENZIE: Has any effort been made to subject buses and trucks to Government recapture of earnings in excess of six per cent on their investment? I think the recapture clause of the Transportation Act is about the most unsatisfactory thing I ever heard of. You have told how efficient management has saved $1,300,000,000, and then they take it and give it to weak lines and buses. If they take it off the railroads they can take it off the buses.

MR. GORMLEY: In this problem we are dealing only with interstate transportation. Interstate regulation has nothing to do with taxes. That is a question for the States. In dealing with this, which is a presentation to the Interstate Commerce Commission, the question of taxes does not appear, though it is referred to. As to the question you raise, there is no regulation in interstate commerce with respect to trucks and buses. There is intrastate regulation in some States but as far as taxation is concerned, judging from railroad experience, I never knew any taxing body to overlook any opportunity for money. I think the States can be depended upon to see to that. But there are a lot of things which are not understood by people at large.

Down in Texas, because of a depression in the lumber industry, there was a large movement of cotton by trucks formerly used for the transportation of lumber. The railroads had to make a reduction in rates to meet the truck rates. The railroads are now prevented under the Fourth Section of the Transportation Act from reducing rates where there is competition, as they are required to extend those rates to a lot of places where there is no competition and they can't afford to do it. If they can be relieved of it they can meet a lot of competition.

Just last week between Alexandria and Richmond, Va., a truck and bus met on a bridge on an 18-foot highway, which had an inside clearance narrower than the highway. They did not clear and one of them fell in the ditch, killing one person and injuring three others. It was found that the bus and truck were each eight feet wide trying to pass on an 18-foot highway. The first proposal made was that the highway was too narrow and that it should be widened. The operation of trucks on the highways is not regulated. The trucks and buses for whom it will be widened

escape all responsibility for the cost. If they come through from New York the only contribution to the State of Virginia is through the gasoline tax. Even then the truck operator has extra tanks and fills them up at a 2-cent tax in Washington with enough to carry him through Virginia. We believe the States finally will take care of these matters. We are talking about regulation. We do not believe taxation is regulation. It is a separate thing.

MR. C. O. DAMBACH: You spoke of 250,000 less cars handling the business. How many miles of main track and second track and side track could be taken up?

MR. GORMLEY: I started to figure that out on two or three occasions. It runs into money. I do not know what it would amount to. But it costs a dollar a day to own a car, whether it stands still or is moving, so there is a saving of $250,000 a day, which is mighty close when everything is considered.

CHAIRMAN: We have with us Mr. Don Moore, Traffic Manager of the Chamber of Commerce. We would like to hear from him.

MR. D. O. MOORE: I do not know that I can add anything to the discussion.

MR. GORMLEY: This is the first time you ever got me in this position, Don. I have had you there.

MR. MOORE: I have enjoyed the talk very much and congratulate the Club on having Mr. Gormley come and make this excellent address.

MR. W. P. BUFFINGTON: I would like to hear you talk a little about the Regional Advisory Boards. I feel they have been a help to the railroads.

MR. GORMLEY: That is the first consideration, the help they could be to the railroads. I supposed everybody knew all about Regional Advisory Boards. They have an interesting history.

Before there were any Regional Advisory Boards in existence, we of the Car Service Division at Washington had no means of accurately ascertaining information as to prospective freight car and transportation requirements throughout the Country.

The Boards started in the Northwest, in a bad situation, in 1922 and 1923. There was a car-shortage up there. There were

places in that district where farmers drove in sixty or seventy miles and found no cars. The same thing in Texas. When we tried to find out exactly how many cars were required to meet any condition we never could get any definite information. We could ask the individual railroad but they knew we were asking every other road the same question and they would inflate their estimates. When they asked for 40,000, maybe they needed 10,000. We found out in large sections, like Texas, they were in the habit of ordering cars that ran within 25 miles of their location. That was the first situation we tried to meet. It was really the reason for the organization of the Boards. We met a lot of producers in the Northwest and asked them to tell us their requirements, what we would have to do to meet their situation three months in the future. We found out that we could get a three-months' picture in advance of just what their necessities were.

One year in Texas there was a drought. They were moving the cattle over the ranges to Kansas where there was feed. The War Finance Corporation had a lot of money loaned on that stock. Those of the Fund said, "If we do not get stock cars down there the cattle will die and we will lose all the money we have in that territory." "Have you any idea what we will have to move?" "No." We inquired of the Public Utilities Commission of Oklahoma, "How many stock cars should we divert to meet your situation?" They were all up in the air. Finally I picked out the General Manager of a railroad who at one time was connected with the Car Service Division. Having had that experience I thought he would be interested. I said, "Will you give us your best information?" He said, "I will give it to you for our own railroad but I do not know whether it is correct or not." We started a stock car movement to Kansas City and St. Louis, etc., and sent them down there in train loads. There was actual loading for only one out of every six cars we sent.

We organized a Board in that industry and said: "You have got to be part of the organization and must give us information if your difficulties are to be met." We moved the stock the next year without any shortage because we knew in advance what was required.

Take the heavy grain movement in Kansas in July. We start preparing for that movement in April, building up the supply in advance, to see that cars are sent out there when needed. We have an Advisory Board down there. In 1929 they worked out

the figures. It looked plenty high enough and we thought we had all the cars they could possibly use. The combine thresher comes in. That is a machine which cuts, threshes, and loads wheat on the truck in one operation. There was a 400% increase in the combine threshers. In less than fifteen days car supply melted and there were 3,000,000 bushels of wheat on the ground. There was no complaint. They could not put it through no matter what the car supply was. We transferred 20,000 cars in fifteen days' time and cleaned it up. What would have been the situation without an Advisory Board to give us information? We would have had an emergency and met it afterwards. Today the operating officer is the public relations man on the railroad. I do not know how the Car Service Division could operate intelligently without the Regional Advisory Boards.

Take the grape situation in California. Prior to 1926 they had refrigerator car shortage every year, and we had no measure of the actual shortage because shippers would ask for five or ten cars in the hope of getting one. Now we require them to file their needs a week in advance of what they expect to load. The man who does not file a car requirement does not get any cars at all if there is a shortage. When we have 72,000 cars of grapes and take about 40% of them to New York, they have to be moved and sometimes quickly. We know in advance what the crop will be and just about when the movement will begin.

Apples in the Northwest; cotton, fertilizer, coal, we can sit in our office in Washington and tell at any time just what the situation is in every part of the United States by the work of these Advisory Boards. If we did not meet the situation we would be on the griddle. We do not propose to be in that position again.

Then we use them for another thing. By increasing the load per car one ton in this Country, means 1,100,000 less car loads required to transport the products of this Country. Take the year 1930, the year of the depression, confronted with the statement that people were ordering smaller loads, we are going to come pretty close to that ton per car increase in 1930 over 1929 on carload traffic. And the Advisory Boards can take most of the credit for that.

MR. D. F. DOWNS: I would like to ask something about the effects of truck bodies and containers, from this point of view.

MR. GORMLEY: Try them all. I would try every means that was offered. You can afford to spend money on research. As to containers, I can see an increase in empty mileage on the return movement of the car with the containers. Merchandise traffic generally moves from the East to the West. I would offer every shipper of freight along the railroad any means of transportation he wants. If he wants to fly, give it to him. If he wants containers give him containers. If he wants truck movement give him truck movement. Anything within the bounds of reason, and go the limit with him on the question of money you can spend, and call it research, or trying to develop the container or any other means of transportation, because after while, unless they build freight truck highways, the freight truck will have a hard time getting through traffic, particularly in this Eastern territory. It will be an unprofitable operation. I believe in the railroad being the last word as a transportation medium regardless of how it is done.

MR. B. H. CANON: The figures furnished by the Allegheny Regional Advisory Board are fairly close. We have had considerbale discussion in our Board about coming within five per cent of the estimates. Is that close enough?

MR. GORMLEY: We have done a lot of figuring and they are the best figures I know of today. I would rather have the figure made by you as a shipper of coal and by the other man as a shipper of steel than to take the word of some economist in a 47-story building in New York. You ought to know. I do not know how he can possibly know. I would rather have the best information you can obtain of what you are going to do than to take it from some theorist. We have over 20,000 people on the mailing list for these forecasts. We did not start it to forecast business at all. We did not go into competition with these economists. We put it out for the purpose of giving the railroads information three months in advance of what the car requirements would probably be. We never claimed it to be a business forecast. Other people have put that name on it. I would rather accept it today as the best information of what the next three months will be than anything else I have seen.

MR. J. W. HOOVER: I am wondering whether a lot of the traffic now going to trucks would come back to the railroads if they were to provide some cars of lesser capacity. Take a

shipper who consistently ships in quantities of five to twenty tons and who is now shipping by truck because of lower rates and quicker delivery—would he be interested in cars of smaller capacity and is there a place for the economic use of lower capacity but well-built cars on the railroads of today? We can all appreciate the gains made through the use of higher capacity equipment which you have so thoroughly explained, but I should like to have your views as to the possibilities of a certain limited number of smaller capacity car units.

MR. GORMLEY: The size of a car does not restrict small shipments. We have nothing to do with minimums. We are charged with responsibility for trying to increase the load. I do not care if minimums are never increased. They are for small shipments. You cannot ship 40,000 pounds on an order for 36,000. The minimum rate is to take care of that condition.

I am against box cars of less than 100,000 pounds capacity. In the case of one steel company in the East an increase in tons per car meant about $9.00 per car. On the basis of their comparison with the previous year that $9.00 per car meant $778,000 increase to the railroads handling it. Part of it was due to larger cars but a lot was due to the activity of the traffic manager of the steel company. The Quaker Oats Company has shown an increase from 3 to 15 tons a car on their commodities and most of it is inbound movement. You can imagine what that means to the railroads. Take a wheat operation. Take all the cars that they run in, then make comparisons on just wheat loading. The freight charges on cars of 100,000 pounds capacity is $90.00 greater than the next car under it. When a railroad handles 30,000 cars of wheat, with 7 to 9 tons less than another railroad, figure how much that company could increase its dividend if they had gone to 100,000 capacity cars ten or twelve years ago.

The argument that small cars will take business away from motor trucks is not well founded. Suppose we had had smaller capacity cars in that wheat movement from Kansas in July, 1929. Forty per cent more cars would have been required to move it. Can you imagine what the congestion would have been in railroad terminals? How many trips would a 100,000 pound capacity car with $90 earnings have to move to pay for its excess cost? Not very long.

One railroad that owns the most of the larger cars, carrying the heaviest tons per car of any commodity, has a movement of

sugar from San Francisco to St. Louis which was being loaded 80,000 pounds per car. It was found that this restriction had been placed by the shipper who claimed that many of the cars were reconsigned in transit and that their customers receiving the reconsigned car could not absorb more than 80,000 pounds of sugar for his current requirements. One of our men checked into the situation to see how many cars were actually reconsigned and discovered that it amounted to one per day. Yet the shipper was limiting all of his consignments to 80,000 pounds per car. With this information, it was not difficult to persuade the shipper to increase the loading to 100,000 pounds and the earnings on the first 80 cars increased $170 per car. Four cars are now carrying as much as five cars formerly with economy to the railroad, the producer, and the consumer.

MR. JAMES L. O'TOOLE: There are two questions I would like to have answered. In the course of his remarks, Mr. Gormley referred to restrictive and burdensome regulations which surround railroad operations as compared with an almost total absence of such regulations applicable to other means of transportation. I am wondering why it is that the public at large, who are primarily responsible for our laws, apparently proceed on the assumption there is need for a "double standard" of morals in the transportation field. When I started in the railroad game many years ago, there was much gossip and hubbub about certain remarks of Commodore Vanderbilt, in the course of which he is alleged to have said, "The public be damned," or something to that effect. At periodic intervals ever since, this alleged remark has been reiterated with variations in speech and print and always with prejudice to the railroads. Insofar as my own personal observation goes, after many years mixing closely with men engaged in all kinds of business, I am frank to express the opinion that, taken by and large, men working for railroads average up to just as high a standard of honesty, truth and morals as folks engaged in any other line of endeavor. That being true, why is it that the public at large apparently feel that the railroad business must have restrictive legislation? Can you answer that question?

MR. GORMLEY: I think it is on account of the previous indefensible activities of transportation offices in the early days. The railroads did exactly what the truck operator is doing today. A large producer came to a railroad with a big tonnage to move somewhere. "What is the rate?" "So and so." "That is the

tariff rate?" "Sure, but we will take off 20%. We will come around and pay you next week." Here is another company also in the steel business and wondering why he cannot compete with the other fellow. He finds he has been discriminated against. The only way to stop it was by regulation. And that regulation was right. Just exactly what the truck fellow is heading for.

MR. O'TOOLE: My second question is this. I am earnestly seeking information. I had the pleasure of attending the meeting of the Great Lakes Regional Advisory Board held at Cleveland yesterday at which Mr. J. M. Fitzgerald spoke on behalf of the railroads, and in the course of his talk he referred to tonnage being diverted from the railroads to waterways, trucks, and other means of transportation, Mr. Fitzgerald intimating, or at least I understood him to state, that the railroads are not permitted to engage in these other lines of transportation because of certain restrictive laws and regulations. Following Mr. Fitzgerald was an eloquent gentleman named Brown, who, as I understand, represented the automotive interests in the motor transportation coordination case hearings recently conducted by the Interstate Commerce Commission. Mr. Brown stated that, speaking as a lawyer, he did not know of any law which prevents the railroads from entering into other means of transportation. What are the facts?

MR. GORMLEY: He either did not know, or evaded the question. There is a law. No railroad today can operate ships through the Panama Canal. The Southern Pacific operates a line from New York to Galveston, but not through the Canal. Freight operated from San Francisco to Los Angeles is competitive to the boat lines under the law. The statement is correct as made by Mr. Fitzgerald. We want that restriction removed.

MR. O'TOOLE: What is the status with regard to the use of the highways?

MR. GORMLEY: They can go into highway operation except where their charter restrictions prevent it. They can go into it by subsidiaries. But they want to figure its stability, the basis on which they can operate, and that is why they do not want to go into it. The larger bus operators would like to have regulation so they could know what competition they have to meet. What is best for the automobile industry is to be able to sell trucks and buses to stabilized, financially responsible, operators. I can't understand their attitude. Wouldn't they rather sell to

the Pennsylvania Railroad, which is financially responsible? How are we going to go into it when we don't know what we have to meet?

MR. FRANK J. LANAHAN: Often have I had occasion to speak of the cosmopolitan character of the Railway Club of Pittsburgh. Nothing could more vividly demonstrate its value as a medium of better understanding from a common ground of interest, than the discussion here tonight. Views have been presented from every walk of life—industrial, financial, educational and transportation—a regular forum. When you can get people interested enough to listen to the other fellow's side and study the problem or contention from both points of view, you canont help but get somewhere. It was most interesting to hear the railroad men express their personal views on the injustice of the present railroad situation. Great is his personal concern, and then why should he not seek redress? We who are earning our living from the railroads should endeavor to see that they get a square deal. Their prosperity is our prosperity, so it behooves each of us to participate in their problems and work out the proper solution. Any of you gentlemen who followed the proceedings of Congress this past session, dealing with the regulations of trucks and motor buses, know how ineffective were the efforts. Now, what is going to happen? Clearly did Mr. Gormley bring out the difficulties surrounding the railroads in their earlier days concerning rebates. Time cured that evil, but the same yardstick applied to the railroads will have to be used on trucks and motor buses, and if it is, it will be better for all concerned. It behooves us to do everything we can. Call it selfish, if you will, for our own best interests, but "Self preservation is the first law of nature."

This has been a marvelous meeting. We have been like school children listening to a professor well qualified to instruct us, and we have imbibed allopathic doses of transportation wisdom.

I should like to move as a token of our appreciation and real enjoyment of the paper and discussion of the evening, that we all rise to thank Mr. Gormley for coming here and delivering this address.

The motion was duly seconded and prevailed on unanimous rising vote. There being no further business, on motion, adjourned.

J. D. CONWAY, Secretary.

RESERVED

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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FEDERAL VALUATION OF RAILROADS AND RECAPTURE OF EXCESS INCOME

By EDWIN F. WENDT, Consulting Engineer, Union Trust Building, Washington, D. C.

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OF

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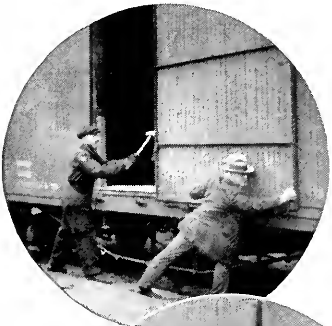

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Meetings held fourth Thursday of each month except June, Ju'y and August.

PROCEEDINGS OF MEETING
APRIL 23rd, 1931

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock, P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Allen, Harvey
Altsman, W. H.
Ambrose, W. F.
Anthony, R. H.
Askin, J. A.
Balzer, C. E.
Barclay, J. R.
Beam, E. J.
Berg, Karl
Bittner, George
Bonhoff, E. L.
Brinkhoff, W. H.
Buffington, W. P.
Burel, W. C.
Campbell, W. T.
Cipro, Thomas
Clark C. C.
Conway, J. D.
Crawford, D. F.
Croke, Thomas F.
Cruikshank, J. C.
Dambach, C. O.
Davies, James
Davin, W. E.
Davis, Charles S.
DeLaney, V. W.
Descamp, J.
Durkin, James E.
Edwards, C. H.
Emery, E.
Endsley, Prof. Louis E.
Emsheimer, Louis
Everstine, A. Perry
Falkner, A. J.
Fisher, Harry G.
Feltcher, A.
Follett, W. F.
Frauenheim, A. M.
Freshwater, F. H.
Fults, J. H.
Gardner, George R.
Geisler, Joseph J.
Gilg, Henry F.
Glaser, J. P.
Glenn, J. H.
Gordon, George A.
Hackett, C. M.
Hall, Chester C.
Haller, C. T.
Hamilton, W. H.
Hansen, William C.
Harvat, F. V.
Hastings, H. S.
Hill, W. D.
Hilstrom, A. V.
Hood, C. E.
Hood, J. M.
Hughes, J. E.
Huston, F. T.
Kelly, L. J.
Kennendy, F. D.
Kernan, J. L.
Kimling, Karl
Kirk, W. B.
Knox, William J.
Kroske, J. F.
Kummer, Joseph H.
Lanahan, Frank J.
Laurent, Joseph A.
Leban, J. L.
Loeffler, George O.
Long, R. M.
Lowry, William F., Jr.
Ludgate, B. A.
Lunden, Carl J.
Lynn, Samuel
Mauck, E. A.
Mayer, L. I.

Meinert, Henry
Mertz, G. H.
Meyers, William F.
Millar, C. W.
Miller, John
Miller, J. A.
Mills, C. C.
Misner, George W.
Mitchell, F. K.
Mitchell, W. S.
Morris, A. T.
Moyer, Oscar G. A.
McIntyre, R. C.
McKinley, A. J.
McPherson, A. R.
Nagel, James
Nannah, F. J.
Ness, H. S.
Nieman, Charles J.
O'Leary, J. J.
O'Toole, J. L.
Paisley, F. R.
Pickard, S. B.
Posteraro, S. F.
Rauschart, E. A.
Reeve, George
Renshaw, W. B.
Rupp, E. S.
Rushneck, G. L.
Ryan, D. W.
Ryan, Frank J.
Sattley, E. C.
Schaaf, A. J.
Schrecongost, C. P.
Schultz, Charles H.
Searles, E. J.
Seiss, William C.
Seroky, Edward A.
Severn, A. B.
Sheets, H. E.
Shannon, David E.
Shellenberger, H. M.
Simons, Philip
Smith, H. K.
Stamm, Bruce B.
Stark, F. H.
Stevens, R. R.
Stucki, A.
Sutherland, Lloyd
Thomas, H. N.
Thomas, Theodore
Touceda, Prof. Enrique
Tucker, J. L.
Uhar, John J.
Van Wormer, G. M.
Weaver, W. Frank
Wendt, Edwin F.
Wheatley, William A
Wikander, O. R.
Woods, Joseph
Woodward, R.
Wright, John B.
Wyke, J. W.
Zammikiel, John

VISITORS

Adler, Edwin
Balph, M. Z.
Berbech, L. J.
Berger, John S.
Carruthers, G. R.
Charles, F. R.
Demskie, J. J.
Dunham, C. W.
Dunn, C. A.
Ferguson, D. S.
Ford, J. R.
Foster, Edwin G.
Fralic, C. F.
Friend, E. F.
Gatefield, Edgar
Geisler, Paul
Giles, R. C.
Gooding, George E.
Goodwin, Arthur E.
Griest, E. E.
Guinnip, W. S.
Harvey, J. H.
Hemma, Charles H.
Hill, E. T.
Hopkinson, J. M.
Johnston, F. D.
Kane, Clarence G.
Lais, G. James
Lewis, S. B.
Lind, Herman H.

Mecusker, M. R.
Meighan, J. A.
Meyers, William B.
Miller, Thomas N.
Mock, J. C.
Moore, J. W.
McFarren, M.
McKee, D. L.
O'Neill, F. C.
Reeve, Frank H.
Ryce, Edwin S.
Schaffer, W. E.
Scharpf, H. L.
Shepherd, W. S.
Smith, Sion B.
Underwood, Walter C.
Walker, J. E.
Whiting, H. F.
Young, M. A.

PRESIDENT: The call of the roll will be dispensed with as we have a record of attendance on the registration cards.

With your consent the reading of the minutes of the last meeting will be dispensed with.

I will ask the Secretary to read the list of applications for membership:

SECRETARY: I have the following applications for membership:

Deneke, W. F., Terminal Agent, B. & O. R. R., Grant and Water Streets, Pittsburgh, Pa. Recommended by J. T. Campbell.

Gatfield, Phillip Adris, Mechanic, Keystone Sand & Supply Company, 2602 Neeld Avenue, Beechview, Pittsburgh, Pa. Recommended by J. L. O'Toole.

Guinnip, M. S., Sales Engineer, Ingersoll-Rand Company, 706 Chamber of Commerce Building, Pittsburgh, Pa. Recommended by J. F. Kroske.

Robinson, John M., Engineer, Railway Engineering Department, Westinghouse Electric & Manufacturing Company, 6100 Bryant Street, Pittsburgh, Pa. Recommended by J. A. Ralston.

Wright, J. L., Supervising Agent, Pittsburgh Division, Pennsylvania Railroad, 303 Fifth Avenue, Carnegie, Pa. Recommended by J. G. Dennis.

PRESIDENT: In accordance with our By-laws these applications will be referred to the Executive Committee, and upon approval by them the gentlemen will become members without further action of the Club.

If there is no further business, we come to the paper of the evening. We have with us tonight a long time member of this Club who needs no introduction to a great many of you. He has been

located in Washington for a good many years but still retains his address here to vote, I presume, and still keeps up his membership in the Club. He was on the Pittsburgh & Lake Erie engineering force for a good many years and it gives me great pleasure to introduce to you Mr. Edwin F. Wendt, who will address you upon the subject "Federal Valuation of Railroads and Recapture of Excess Income."

FEDERAL VALUATION OF RAILROADS AND RECAPTURE OF EXCESS INCOME

By EDWIN F. WENDT, Consulting Engineer, Union Trust Building, Washington, D. C.

MR. PRESIDENT AND FELLOW MEMBERS:

I have been a member of this Club for twenty-five or more years, and I assure you that it is a real pleasure to be present and address you this evening.

Eighteen years ago on May 1, 1913, I resigned from the Pittsburgh & Lake Erie Railroad, and entered the service of the Interstate Commerce Commission where I remained for eight and one-half years until October 31, 1921.

On March 20, 1913, I was elected President of the American Railway Engineering Association, and upon taking the chair I made some remarks which were responsible, in some measure at least, for my selection as a Member, Engineering Board, Bureau of Valuation, Interstate Commerce Commission. Among other things I said:

> "A new problem has now arisen—a gigantic problem we think. Congress passed the railway Valuation Act on March 1, 1913, and the Interstate Commerce Commission is charged with the duty of valuing the railways of this country promptly. The results of this work will be of tremendous importance because of the large amount of capital invested in the business.
>
> "We have members who are capable to do this work, and it behooves every member of our organization to intelligently direct his energies toward the proper solution of the problem which is now before the country."

The Valuation Act required the Commission to begin work within sixty days after the approval of the law, and on May 1, 1913, an Engineering Board, composed of five engineers, was or-

ganized in Washington for the purpose of supervising the railway valuation work.

Congress had authorized the Interstate Commerce Commission to prescribe accounting regulations for railroad companies as early as 1906, the first authoritative classifications becoming effective July 1, 1907. At that time an idea was prevalent in the minds of many people that the railroads of this country were over capitalized. This idea lead to the passage of the Valuation Act which authorized the Commission to investigate, ascertain, and report, the valuation of the properties of all common carriers.

It is interesting to note that the valuation of railroads which has been prepared by the Commission during the past eighteen years shows that the railroads are not over capitalized as a whole.

I said in my Chicago speech in 1913 that the valuation of the railroads was a gigantic task, and the late Senator Cummins of Iowa, who at that time was one of the leading students of the railroad problem in the United States, said in one of his speeches that this work was the most herculean task ever undertaken by any government since the days of Julius Caesaer.

The Engineering Board began its work without any precedents for its guidance. The law required the Commission to ascertain, investigate, and report, the value of the railroads in great detail. It was necessary to prepare an inventory, and to list the physical units of property in detail in accordance with the classification of investment in road and equipment. The problem was to inventory, price, and value 250,000 miles of steam railroad, 200,000 miles of telegraph lines, the Pullman Company, Railway Express Agency, and all interstate electric railways, telephones and pipe lines.

When Congress had this legislation under consideration, witnesses who claimed to be experts appeared before the committees and stated that the work could be done in about three years at an expenditure ranging from $3,000,000.00 to $5,000,000.00. Experience showed that the work required eighteen years at an expenditure of $50,000,000.00 by the Government, and more than $100,000,000.00 by the railroad companies.

After the Engineering Board was authorized, it estimated that the field work would require seven years, and this estimate was substantially correct. The Board never committed itself as to the probable cost of the entire work. What it did was to estimate that the maximum expenditure per year, after the forces were fully organized, would be $3,500,000.00.

The United States was divided into five Districts which were designated as Eastern, Central, Southern, Western and Pacific. Each District included approximately 50,000 miles of railroad. Five complete technical staffs were organized and located at the headquarters of each District, Washington, D. C., Chicago, Ill., Chattanooga, Tenn., Kansas City, Mo. and San Francisco, Cal. These technical staffs consisted of:

Civil Engineer in charge of roadway and track.

Bridge Engineer in charge of structures.

Architect in charge of buildings.

Mechanical Engineer in charge of locomotives, cars and shop machinery.

Electrical Engineer in charge of power plants and electric traction.

Signal Engineer in charge of signals and interlockers.

Telegraph and Telephone Engineer in charge of telegraphs and telphones, and a complete engineering office organization for the assembling of the data into Engineering Reports.

The length of each and every road, including main tracks, spurs and sidings, was measured by engineering corps fully equipped for this work. All excavations and embankments were cross sectioned. The bridges, buildings, signals, water stations, fuel stations, shops, roundhouses, turntables, cars, locomotives, shop machinery, signals, interlockers, telegraphs, telephones, gas plants, power plants and all appliances of every descripton were inspected, measured, enumerated and computed in accordance with the standard practices of the engineering profession. The field work of making the inventory measurements, and the office work in connection with the computations, collections, and assembly of the quantities and classes of property was done with care and thoroughness. The work was done under printed instructions governing the roadway, bridge, building, signal, mechanical, electrical, and telegraph departments. The maximum force of engineers, accountants, and land appraisers engaged at one time on this work was in excess of 1500.

The Valuation Act required the Commission to list the property in detail, and it was therefore necessary to report the kind, class and weight of the rails in 400,000 miles of main track and sidings. The lightest rail found in 1914 was 40 lbs. per yard, and the heaviest rail 125 lbs. per yard. Cross ties, bridge ties, ballast, switch stands, and all other track details were reported in a similar

manner. It was necessary to prepare bills of material for buildings, compute the cubic yards of masonry, and the pounds or tons of steel in bridges, describe the classes and details of locomotives, cars and shop machinery, and in general to report all physical property in commercial units in exactly the manner followed by engineers in building new railroads.

There were in this country in 1913 when the law was passed about 2000 railroad companies, but many were operated under leases, and the number of common carriers was about 1000. For example, the Boston & Maine Railroad Company in 1914 when it was valued included a large number of corporate properties. The Pennsylvania, New Haven, and New York Central included many subsidiary corporations, all of which were operated by a single common carrier.

The Commission has prepared valuations of 1087 common carriers in accordance with the requirements of section 19a of the Interstate Commerce Act commonly called the "Valuation Act." There are today less than two hundred Class I common carriers, and it follows that there are over 800 short lines which remain to be consolidated with Class I roads. It is sometimes asked what is a short line, and the usual answer is that it is a railroad short of money.

The Valuation Act required the Commission to ascertain the original cost to date, cost of reproduction new, and cost of reproduction less depreciation. It soon became evident that it was a practical impossibility to ascertain the original cost of more than a few railroads. In the preparation of estimates of cost of reproduction new, it was decided to use prices as of June 30, 1914, and the selection of this date was in some respects an accident. The valuation forces were assembled before the outbreak of the World War in 1914, and it was deemed advisable to collect cost data as of this date in order that work might proceed. Manifestly the great change brought about by the World War was not foreseen. Naturally the World War caused radical changes in prices and values, but the Commission decided to complete what is commonly called the "19a valuations" on the basis of pre-war prices in order that the work might be finished on a common basis. It should be clearly understood that all valuations prepared by the Commission during the past eighteen years have been on the basis of prices as of June 30, 1914.

After the field work had been completed, it was necessary to

compute, collect, assemble, and price the data, and classify the property under the groups, owned and used, but not owned, and jointly used. The law also required that the property be assembled and reported by states as well as by corporations. Thus it became necessary to maintain a large office organization for the purpose of completing the Engineering Reports in the detail required by Congress.

The law requires the Commission to make an original valuation, and to prepare corrected up to date valuations from time to time. Original valuations were made by the Commission as of different years from 1914 to 1920. For example, the basic date of valuation of the Pittsburgh & Lake Erie was 1916, New York Central 1917, Pennsylvania, and Baltimore & Ohio 1918, Monongahela Connecting Railroad 1919, and Unity Railway 1920. However, all of these valuations were prepared on the basis of prices as of June 30, 1914. Since it required eighteen years to finish the basic valuations, the Commission has had very little opportunity to prepare the corrected and up to date valuations which are contemplated by the law.

Previous to the World War there was very little difference between the original cost and cost of reproduction new of railroads. The Commission held that its estimate of cost of reproduction new on the basis of pre-war prices was substantially equal to the original cost of construction during the previous twenty years. Under these circumstances, it made little or no difference whether a valuation was prepared on the basis of original cost or cost of reproduction new. However, following the World War the cost of construction of railroads increased so that in the period from 1923 to 1927 new railroads actually cost about 70% in excess of the 1914 cost. Thus there was precipitated a great controversy as to whether the present value of a railroad in 1931 is to be measured by the original cost or its present cost, commonly called cost of reproduction. This is a legal question. Railroad men are familiar with actual costs. They think in terms of present cost, and they are not concerned with legal theories. The lawyers say that value is a legal concept. Practical railroad men know what it would cost today to build any of the railroads in the Pittsburgh district, or any other part of the country. Locomotives, cars, rails, ties, buildings, and bridges, cost so much money as of the present time, irrespective of what prices may have been paid in 1930, or any

other date during the past one hundred years within which the railroads have been built and developed.

The controversy as to the method to be followed in valuing railroads has become acute, due to the fact that the Commission is endeavoring to collect excess income from carriers. Congress passed the Transportation Act in 1920, which provided that rates should be set to enable the railroads as a whole to earn a fair return, provided that one-half of all income in excess of 6% of the value should be recovered by the Interstate Commerce Commission and held by the Government. Since the completion of the basic valuations, the Bureau of Valuation of the Commission devotes its energies to the preparation of Tentative Recapture Reports on the basis of post-war prices. The Commission has almost 1,000 employes engaged in recapture work at an expense of about $3,000,000.00 per year. An attempt was made some five years ago to collect excess income from the St. Louis & O'Fallon Railroad Company. This is commonly known as the O'Fallon case. The Commission valued the property substantially on the basis of 1914 prices, and the carrier secured an injunction. The Supreme Court decided in favor of the carrier and held that the Commission in preparing its valuation for recapture purposes should give consideration to cost of reproduction new at present prices. Thus it became necessary to prepare Recapture Reports on a different basis.

The Commission then heard and decided the Richmond, Fredericksburg & Potomac Railroad Company recapture case. Estimates were prepared by the Commission showing the original cost. The road was chartered in 1834, built in 1835, '36 and '37, and developed during the past ninety-seven years. An estimate of cost of reproduction new was also prepared by the Commission showing that the present cost of building the railroad would be 70% in excess of the original cost. Depreciation was ascertained and deducted. The present value of land was determined. The hearing in this case extended over a period of five years.

The Commission found that there was no record of the original cost of this road. It was built in 1835 with strap rails weighing 20 lbs. per yard. At the present time the road is laid with 130 lb. rail. The Commission found a valuation as of 1923 in an amount which exceeds its estimate of original cost, and is greatly less than its estimate of cost of reproduction

less depreciation. It is a practical impossibility to determine the original cost of any of our great railroads, and all estimates of original cost are probably too low. The Commission states in its decision that consideration was given to present cost as well as original cost, but no explanation is made of the weight which was accorded to either of these elements of value. Some think that the Commission gives about 60% weight to present cost, and about 40% weight to original cost, but these are mere guesses, and it is impossible to ascertain the method followed by the Commission in the determination of final value. Suffice it to state that the report of the Commission contains its estimates of original cost, cost of reproduction, cost of reproduction less depreciation, present value of land, material and supplies, and cash working capital.

It is a serious matter to recover excess income from railroad companies, particularly in view of the fact that the railroads of this country since 1916 have never earned a fair return, and the fact is that during the present depression of 1931 they are probably not earning one-half of a fair return. Naturally the railroad companies resist the attempt to collect excess income on the ground that they do not earn more than a fair return on the basis of a valuation prepared in accordance with a correct interpretation and application of the law.

Two subjects are involved, first the value of the property and, secondly, the income earned from the operation of the property. While there are some difficulties in the determination of the amount of net railway operating income, they are few and simple in comparison with the difficulties incident to the determination of the present value of the property as a whole in a going condition. Railroads are not bought and sold like other forms of property, and there is no market value. It is true that shares of stock are sold and purchased on the exchange, but they represent simply an equity in the ownership, and the prices paid are not necessarily representative of the value of the property under the law.

The valuation of a railroad involves engineering, accounting, economics, and the law. There are two theories, among others, of valuation which are advocated. The railroads usually claim that the present cost of construction less depreciation is the best evidence of value, whereas many shippers claim that original cost should be considered as the measure of the value. Thus

we have two contending parties, and it will be necessary for the Supreme Court to decide what weight is to be given to the present cost of construction in the determination of value for recapture purposes.

A small number of railroad companies have paid to the Commission, under protest, about $10,000,000.00 of excess income. This money cannot be used by the Government because it was paid under protest before any final determination was made by the Government. The Commission is now actively engaged in the preparation of Tentative Recapture Reports, and it is anticipated that about two hundred railroad companies will be held to be subject to the recapture of excess income. This work is being done in accordance with the Transportation Act whose principal features are:

1. Preparation of a plan for the consolidation of the railroads into a limited number of systems.
2. A rate structure designed to enable the railroads as a whole to meet their financial problems by providing for a reasonable return on their present value.
3. The recapture clause of section 15a which provides that if any road earns more than 6% on its value, one-half of such excess should be recovered by the Interstate Commerce Commission.

It is interesting to note that the Commission's valuation of the railroads as a whole will probably be in excess of the property account shown by the books of the railroad companies, and considering the railroad industry of the United States there has been no excess income at any time since the passage of the law in 1920. The return on the property investment of railways, excluding switching and terminal companies, during the past ten years was as shown in the following table:

1920	0.06%
1921	2.95%
1922	3.73%
1923	4.56%
1924	4.43%
1925	4.89%
1926	5.14%
1927	4.40%

1928	4.75%
1929	4.96%
Average	3.99%

The Commission has found the recapture work to be burdensome as well as troublesome, and in its 44th Annual Report submitted to Congress in December 1930, it recommended the repeal of the law in a statement, a portion of which is quoted as follows:

> "Not only is such procedure very expensive to the Government and to the carriers whose funds are derived from the public, but it also involves, we fear; other dangers to the public interest. To state the matter boldly and frankly, litigation over questions of valuation, accounting, and administration will arise in cases where the basic issue is whether or not, or to what extent, money shall be taken from carriers by the Government and possibly, in some instances, under financially embarrassing conditions. The unconscious influence of the surrounding circumstances is not unlikely to be such that the result will be to establish, in the course of this litigation, certain principles relative to valuation and the like which will have an unfavorable reaction on many broader phases of public regulation.
>
> "We are inclined to the opinion that these practical objections outweigh the theoretical advantages of recapture, and that the wiser course to pursue is to repeal the recapture provisions in their entirety, rather than attempt to improve them by amendment. Certainly, this is a matter which is deserving of the most careful consideration by the Congress."

If the recapture clause is not repealed, it seems certain that the interpretation and application of the law will be in litigation during the next twenty years. The Commission's recommendation is a note of encouragement to the 300,000 railroad men who lost their jobs during the present depression because if railroads are required to pay additional taxes to the Government, the recovery from depression will be retarded, and the possibility of the re-employment of this large number of railroad men will be delayed for many months, and possibly several years. Strange as it may seem, the recapture law makes no provision for leveling

down the peaks, and leveling up the valleys of railroad income. This is a serious defect. No doubt the Commission took this point into consideration when it made its recommendation. Theoretically, recapture may be regarded favorably, but the Commission reached the conclusion that "practical objections outweigh the theoretical advantages of recapture." The railroad men who construct, maintain, and operate the railroads will certainly agree with this statement of the Commission.

There is considerable pessimism concerning the present railroad situation. Naturally the 300,000 unemployed railroad men are anxious to be taken back into railroad service. I think the outlook is better than it is represented to be. It is said that waterways, pipe lines, aeroplanes, and motor transport, are taking large amounts of business formerly handled by the railroads. It is true that new forms of competition have arisen, and naturally each competitor secures a portion of the business. However, it should be remembered that the population of this country increases 1,500,000 people per year, and there is more business to be divided among the various transportation agencies. Naturally additional facilities must be provided. However, the steam railroads are the backbone of the transportation industry. It is authoritatively stated that the commercial freight traffic within the United States for 1928, excluding the Great Lakes system, was distributed among the several transportation agencies as follows:

Steam railways	90.2%
Motor trucks (interurban)	1.9%
Electric railways	0.2%
Pipe lines	5.7%
Aeroplane	0.2%
Inland waterway (excluding Great Lakes)	1.8%
Total	100.0%

Thus it appears that motor trucks, pipe lines, aeroplanes, inland waterways, and electric railways, handle about 10% of the commercial freight traffic of this country whereas the steam railways handle 90%. Traffic at present (April 1931) is 20% below normal, and railroad people are discouraged, but when the depression passes and business becomes normal, it will be found that the country is absolutely dependent upon the steam railroad to supply the great bulk of the transportation which is

needed for the comfort and convenience of the people. It may well be that not since Watt watched the boiling teapot and upset the centuries old economic life of Europe by inventing the steam engine has a nation faced a revolution in economic and social life such as confronts the American people today, but the best thought is that the railway will continue as the principal transportation agency. The advantages of co-ordinated transport (rail, highway, water, air) are so great that their appeal to shippers and the general public are irresistible. Economic needs must be met, and laws and practices will inevitably be changed so that railroad companies may supply any form of transportation desired by the public. The great railroad systems of America, as well as England, are now organizing, or planning to organize auxiliary services for transportation on highways, waterways, and the air, so as to serve the people as they may desire. Men who are trained in transportation by rail are the best qualified persons to operate these auxiliary services.

With confidence in the continued growth and industrialization of America, I am satisfied that the future of the railways as general transportation agencies providing any form of service which shipper or passenger may desire is assured. The years to come are likely to require more rather than less transportation from the steam railroad.

PRESIDENT: I am sure we have all enjoyed this talk this evening. For myself, it has given me some very enlightening points on how the Commission finally decided to do their work. I had the pleasure at one time of reading the law and I wondered how they were going to do it. I did not think they could finish it in three years.

The paper is now open for discussion, if any of you wish to say anything or ask any questions.

MR. C. O. DAMBACH: I would like to ask the speaker a couple of questions, first, as to the present status of depreciation on rolling stock and whether a decision has been arrived at as to depreciation on fixed structures. Second, whether the Commission in arriving at recapture recognizes the features of amortization, obsolescence and appreciation, ie: (A) In case of amortization, if you should build a new railroad and handle the tonnage from a coal mine or a lumber camp could you amortize depreciation charges each year and charge to operating expense with a

view to having nothing but salvage left after the industry has been depleted. (B) Regarding obsolescence, there are thousands of locomotives being carried on carriers books today that are obsolete and if the proper charge was made for obsolescence it would automatically increase their operating expense and decrease the net for recapture purposes. (C) Regarding appreciation, we have recently built a new railroad and have a green roadbed. In ten or twenty years that roadbed will be a good deal more valuable than it is today. Has any recognition been given to that feature in arriving at recapture?

MR. WENDT: Two questions are involved—depreciation and amortization.

The Commission has wrestled with the matter of rates of depreciation for ten years in accordance with section 20 (5) of the Interstate Commerce Act which provides that:

> "The Commission shall, as soon as practicable, prescribe, for carriers subject to this Act, the classes of property for which depreciation charges may properly be included under operating expenses, and the percentages of depreciation which shall be charged with respect to each of such classes of property, classifying the carriers as it may deem proper for this purpose. The Commission may, when it deems necessary, modify the classes and percentages so prescribed."

The hearing on this subject ran for almost five years which resulted in the issuance of Order 15100. This Order was subsequently suspended and the hearing was reopened to receive further testimony. It now seems probable that the Commission will issue Order 15100 before the close of this year.

In the matter of amortization of investment, railroad companies are permitted to make charges to operating expenses or profit and loss, subject to circumstances, provided they can prove by good, sufficient, and reliable testimony that the railroad has a definite life depending upon the exhaustion of traffic such as limestone, oil, lumber, iron ore, other natural resources, and conditions which limit the service life of the railroad as a whole.

Appreciation is also recognized by the Commission in its valuation decisions, but not in the accounting. No separate allowance for this element of value is determined, so far as the

reports indicate, but the Commission states that it considers this as an element of value.

MR. DAMBACH: How about obsolescence?

MR. WENDT: That (obsolescence) is considered by the Commission as a part of the 20% depreciation which is ordinarily deducted from the cost of reproduction new in the various valuations under section 19a. Obsolescence amounts to about one-half of the 20% which is deducted. The balance represents physical depreciation in the form of wear and tear, but the Commission does not separate obsolescence from physical deterioration in the preparation of its estimates and reports. Opinions differ as to what part of depreciation is represented by obsolescence, but some of our leading engineers have testified in valuation cases that fully one-half, and possibly more, of all depreciation measured by the Bureau of Valuation is obsolescence rather than loss of service life due to wear, tear and the weather.

PRESIDENT: Are there any other questions? Mr. Stark, you have not been here for some time. Have you anything you would like to say?

MR. F. H. STARK: I hesitate to take up your time because I am not in touch with the details of railroading as I ought to be. I want to say that I have enjoyed this discussion tonight. Mr. Wendt has given us facts that are official regarding the methods by which the Commission would recapture some of these excess earnings, that I do not recall ever having read in anything that was even semi-official. I was not aware that any of the excess earnings had been turned over to the government. Of course we must all appreciate that you can not take the earnings of any individual road and make a freight rate based on the earnings of that particular road, because it would put other roads less fortunate out of business. Consequently it is logical to take the excess earnings of those few roads that are unusually situated. But as the speaker has said tonight it might be well if that particular phase of the law were repealed because it would enable the railroad officials to be just a little more honest in their statements. We all know that a railroad that knew it would have to turn over part of its earnings would use every effort to get it covered up in its statement so as to avoid suffering. So in order to keep the railroad people honest it ought to be repealed.

One thing I can say honestly about the mechanical departments of railroads, I was always proud of the fact that the government had confidence in the mechanical departments, particularly the traffic department. We are all aware that the interchange of cars over the United States in order to expedite movement has to be carried out by the interchange of cars all over the country, and the cost of equipment and its maintenance has to be taken care of. The railroad mechanical departments authorize the railroads to charge each other for repairs made, and the total cost of that runs into millions of dollars. And it is all based on integrity. It is wonderful the way the mechanical departments carry on their interchange of cars and adjustment of costs and there is nothing that compares with it in commercial business or industrial or anything else. And I used to be proud of the fact that the ordinary car man was entrusted with all responsibility in dealing fairly with each other to an extent that there is nothing to compare with it in railroad circles.

I always enjoy coming here, though I know the old familiar faces are disappearing one by one, but I appreciate the friendship of old acquaintance and I am proud that I can go into the office of some of the railroad men I have been associated with, and I am always received cordially, and if I want a favor I do not hesitate to go and ask for it and as a rule I can get almost anything that is reasonable, even a good dinner.

One thing I want to say for the encouragement of the young men. We all know L. H. Turner, Redding, and a lot of the old pioneers were given to hospitality and the exchange of favors and it was no unique thing for us to get something of a material advantage from the exchange of favors. But the young men of today are afraid of their shadows. Life is too short and we ought all to feel that we can approach each other and ask for anything that is reasonable.

I want to say that I appreciate Mr. Wendt's paper as I used to appreciate him personally years ago when he was associated with the engineering department of the P. & L. E. He is a fine fellow.

PRESIDENT: Mr. Lanahan, you are a past president, too. What have you to say?

MR. FRANK J. LANAHAN: A bit disconcerted am I by the eloquence of my good friend, Mr. Stark. Drifting towards the horizon of which our friend alludes, I like to think of the

railroad fraternity as a bond or union, a decided spirit of co-operation irrespective of the large number of departments in the organization. Though there may have existed what might be termed "family differences," they presented to the outside world a solidity that was most admirable. May I repeat a little verse that we like to quote down in the classic precincts of McKees Rocks:

"There is so much good in the worst of us,
And so much bad in the best of us,
That it never behooves any of us
To talk about the rest of us."

So let us pay tribute not alone to the geniuses who compose the mechanical department, many of whose representatives are with us here tonight, but to share bountifully with the absent, those ever active, ceaseless much-maligned, trafficmen. Mr. Stark adequately expressed the feeling of all of us in extolling the merits of Mr. Wendt's paper. I can but compliment the speaker on his presentation of this theme and would request that it be produced in its entirety in the Club proceedings. It would be invaluable as a reference to all of us, for the subject is one of almost constant discussion, and the pertinent facts disclosed to us tonight would be splendid ammunition in any controversy arising that advocates ridiculous tendencies. I am sure all of us who are interested in transportation can feel in accord with the decision of the Supreme Court. The anticipated verdict covering the Richmond, Fredericksburg & Potomac case we will all look forward to noting with considerable expectancy. All of us know full well that if we are deprived of the incentive of gain from our labors, if there is no return to come from the performance of our work, we will be very reluctant to put forth our best efforts. That is just as true of railroads as of individuals.

I want to thank Mr. Wendt for coming here and I want to thank him for his presentation of these facts, and I hope that eighteen years will not go by again without seeing his genial and happy countenance at our meetings.

MR. J. L. O'TOOLE: I want to answer the point raised by Mr. Lanahan in connection with Mr. Stark's remarks. The latter referred to the high regard he has for the mechanical and car departments, his remarks leading you to believe he does not think so well of the traffic department. Nevertheless, when in need

of a meal or drink, it will be observed he admits that it is to the operating or transportation department that he goes.

I hope the suggestion made by Mr. Lanahan will be carried out and that every word of Mr. Wendt's splendid presentation will be reproduced in our minutes as well as any additional data or information on the subject which Mr. Wendt felt the time would not permit him to give to us this evening. I listened very attentively and with great appreciation to all the speaker had to say. Without wishing to appear facetious in commenting on what he has said to us when he was telling us about the purposes and intent of the Congress that enacted the law under which the Commission must proceed in determining the valuation of a railroad, there came into my mind the story of the two Irishmen who were discussing the Einstein Theory. One of them claimed to understand it and when asked by the other to explain it, said: "Well, with a thorough knowledge of the Einstein theory, a man is always able to know more and more about less and less." Maybe if we could locate this Irishman and put him to work, he could tell us just what the Congress meant, thus saving the further time and labor of the Commission and Courts, and at the same time avoid the wasting of additional millions of money by the public and the railroads.

PRESIDENT: It always seemed to me that this recapture part was a penalty on good management. Has any one else anything to add to the discussion?

MR. J. E. HUGHES: Mr. President and Gentlemen:—I can not add anything to what has been said with reference to the splendid address that has been given us by an associate of the Pittsburgh & Lake Erie Railroad tonight. I am not quite as eloquent in telling stories as my friends Lanahan and O'Toole, but I think my operating associates ought to feel proud that our friend Mr. Stark omitted the operating department in his distribution of bouquets.

With your permission I would like to offer a motion that we extend a rising vote of thanks to the speaker of the evening for his most eloquent and instructive address.

The motion prevailed by unanimous rising vote. There being no further business, on motion adjourned.

(Through the courtesy of the Artists Booking Service, Station KDKA, a special feature of entertainment was provided presenting the Roth Trio, Vocalists, which was well received).

J. D. CONWAY, Secretary.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of Official Proceedings—Railway Club of Pittsburgh, published Monthly, except June, July and August, at Pittsburgh, Pa., for April 1, 1931.

STATE OF PENNSYLVANIA }
COUNTY OF ALLEGHENY } ss:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

Publisher Official Proceedings—Railway Club of Pittsburgh.

Editor, J. D. Conway, 515 Grandview Avenue, Pittsburgh, Pa., (19th Ward.)

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Vice President, J. E. Hughes, Pittsburgh, Pa.

Secretary, J. D. Conway, Pittsburgh, Pa.

Treasurer, E. J. Searles, Pittsburgh, Pa.

Known Bondholders—None.

J. D. CONWAY.

Sworn to and subscribed before me this 26th day of March, 1931.

(Seal) AGNUS B. SHAW, Notary Public.
(My commission expires March 9, 1935.)

RESERVED

OFFICIAL PROCEEDINGS

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ENFORCEMENT OF SPECIFICATIONS FOR BRIDGE AND ROAD CONSTRUCTION

By P. J. FREEMAN, Chief Engr., Bureau of Test and Specifications, Department of Public Works, Allegheny County, Pittsburgh, Pa.

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PROCEEDINGS OF MEETING

May 28th, 1931

The meeting was called to order at the Fort Pitt Hotel at 7 o'clock P. M. Eastern Standard Time, with President L. E. Endsley in the Chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Allen, Harvey
Altsman, W. H.
Askin, J. A.
Beam, E. J.
Berg, Karl
Cannon, T. E.
Carson, John
Christy, F. X.
Conway, J. D.
Courtney, H.
Croke, Thomas F.
Dalzell, W. E.
Dambach, C. O.
Davis, Charles S.
DeLaney, G. C.
Dickinson, F. W.
Durkin, James E.
Edwards, C. H.
Emsheimer, Louis
EnDean, J. F.
Endsley, Prof. Louis E.
Everstine, A. Perry
Flinn, R. H.
Frauenheim, A. M.
Freshwater, F. H.
Fults, J. H.
Geisler, Joseph J.
Glenn, J. H.
Haller, Nelson M.
Hansen, William C.
Holmes, E. H.
Hood, J. M.
Hoover, J. W.
Hughes, John E.
Johnson, A. B.
Kelly, L. J.
Kirk, W. B.
Kroske, J. F.
Lanahan, Frank J.
Lanahan, J. S.
Laurent, Joseph A.
Leban, J. L.
Lindsay, J. H.
Lobez, P. L.
Longdon, C. V.
Ludgate, B. A.
Lynn, Samuel
Mayer, L. I.
Meinert, Henry
Mitchell, F. K.
Mitchell, W. S.
Morgan, Homer C.
McAbee, W. S.
McKinley, John T.
McLaughlin, H. B.
McNelty, A. P.
Ralston, J. A.
Redding, P. E.
Robinson, John M.
Ryan, D. W.
Saltic, Thomas
Schultz, D. C.
Seroky, Edward A.
Severn, A. B.
Sheets, H. E.
Sheridan, T. F.
Snyder, F. I.
Stark, F. H.
Stucki, A.
Sutherland, Lloyd
Thomas, Theodore
Wheatley, William
Wildin, George W.
Woodward, R.
Wright, Edward W.
Wright, John B.
Young, F. C.

VISITORS

Aaron, Paul S.
Armstrong, Joseph G.
Betz, C. W.
Berbach, L. J.
Brown, Norman F.
Carruthers, G. R.
Ellison, J. V.
Freeman, P. J.
Gore, James
Groh, F. W.
Hass, J. W.
Helick, R. H.
Jerry, Paul
Kaltenbacn, E. G.
Lewis, S. B.
Nutter, A. D.
Ott, Jacob
Reeve, F. J.
Richardson, G. S.
Schmidt, E. L.
Smith, Sion B.
Spangler, Miss
Stritmater, Mrs. Joseph
Stritmater, Joseph
Wheatley, William
Woods, J. R.

Prior to the business session the Club was entertained by a program of vocal music by Mr. Joseph Stritmater, Baritone of the New Castle Male Quartette, accompanied at the piano by his wife, which was received by the members with enthusiasm.

PRESIDENT: I am sure the Club through me wish to thank Mr. Stritmater and his wife for their courtesy in coming out here tonight and giving us this very delightful music.

We will dispense with the roll call, as the registration cards give us a complete record of the attendance.

With your permission we will dispense with the reading of the minutes of the last meeting, as they are already in print.

The Secretary will now read the list of applications for membership.

SECRETARY: The list of applications at this meeting is very brief.

Barton, C. B., Assistant General Passenger Agent, Seaboard Air Line Railway, Union Trust Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Freeman, P. J., Chief Engineer, Bureau of Tests and Specifications, Department of Public Works, Allegheny County, City County Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Keller, R. B., Air Reduction Sales Company, 1116 Ridge Avenue, N. S., Pittsburgh, Pa. Recommended by J. A. Warfel.

PRESIDENT: These names will be referred to the Executive Committee, in accordance with our by-laws, and upon approval by them the gentlemen will become members without further action of the Club.

SECRETARY: Since our last meeting we have received word of the death of one of our members, W. R. Wilson, General Yard Master, B. R. & P. Ry., Butler, Pa., who passed away April 29, 1931.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

If there is no further business, we come to the paper of the evening. I find that our speaker came from the same part of the Mississippi Valley that I did, Indiana, and I take great pleasure in introducing to you Mr. P. J. Freeman, Chief Engineer, Bureau of Tests and Specifications, Department of Public Works of the County of Allegheny, who will address us upon the Enforcement of Specifications for Bridges and Road Construction.

ENFORCEMENT OF SPECIFICATIONS FOR BRIDGE AND ROAD CONSTRUCTION

By P. J. FREEMAN, Chief Engineer, Bureau of Test and Specifications, Department of Public Works, Allegheny County, Pittsburgh, Pa.

During the past seven years Allegheny County, Pennsylvania, has been engaged in a Road and Bridge building program unequalled by any other County in the United States. During that time more than eighty-five bridges have been constructed and several hundred miles of Highways reconstructed or resurfaced. At the beginning of this program it was realized that it would be necessary to have an extensive organization to carry on this work. Most of you are familiar with the fact that the Commissioners of Allegheny County engaged Norman F. Brown, an experienced Railroad Man, to organize a new Department of Public Works to handle the design and construction of Bridges, Roads and Buildings.

You will recall that it was necessary to raise a number of our Bridges on account of the fact that the United States War Department insisted that the bridges, as they were located in 1924, acted as an obstruction to navigation. In order to develop the new Department of Public Works, Director Brown invited a number of Consulting Engineers to join his new organization, and the writer was asked to act as Chief Engineer of a Bureau to be created for the development of specifications for use in construction work, and a Testing Laboratory for the necessary chemical and physical tests.

Since the entire Department of Public Works was new there

were few old prejudices to overcome and no antiquated equipment to be used. The new organization of the Department of Public Works consisted of four principal Bureaus—Bridges, Roads, Architecture and Tests and Specifications.

It was realized at the outset that in the enforcement of specifications for Bridge and Road Construction that the specifications themselves must always be enforceable. It is not possible to properly enforce a specification for material or methods of construction which is unfair to the producers of such material, or have requirements which cannot be complied with on account of weather conditions or other causes beyond the control of human ability.

The writer had had experience with the State Highway Department of Kansas and the Pittsburgh Testing Laboratory, which had shown the importance of having specifications which would obtain the best possible material for the purpose, but still not be so rigid that the material could not be obtained from the regular sources of supply. It was recognized that a Bureau of Tests, as it is usually organized, does not carry sufficient authority to assist in the enforcement of specifications, and Director Brown proposed that the new Bureau be a combination one dealing with Tests and Specifications. This was a new departure in the enforcement of specifications, and the only change which the writer feels should be made is to reverse the order and make it a —"Bureau of Specifications and Tests."

The activities of the Bureau of Tests and Specifications extend throughout the Department of Public Works and, in general, the Bureau co-operates with the other Bureaus in the preparation of specifications for materials, methods of construction and in the enforcement of such specifications. It has been found very necessary to have the co-operation of the Engineers in the field in the work of the Bureau of Tests and Specifications. To that end, the Field Engineers are furnished with equipment for making as many tests of materials in the field as the nature of such materials will permit. Undoubtedly the Engineer in Charge of a job is better qualified to judge as to the suitability of a concrete aggregate, for example—for use in the particular construction at hand than could be determined from a sample taken to the Laboratory. In order to do this he should have the results of field tests made by an Inspector in order to guide his judgment, and in cases of controversy the Engineer from the Bureau of Tests and Specifica-

tions is always available to make as many tests as may be necessary to determine the quality of the aggregate.

On the other hand, samples of steel, bituminous materials and similar products cannot be inspected in the field, and the function of the testing laboratory is to see that such materials comply with the specifications before they are delivered to the Job. In order to effectively enforce such a mutual arrangement between any two Bureaus, it is necessary to have a clear understanding as to the respective activities and duties of the two Bureaus. It is also very necessary to know the sources of supply of all materials and to have records covering shipments of all such materials.

In order that there would be no overlapping between the Construction Bureau handling a given project and the Bureau of Tests and Specifications it was agreed that the latter should engage in activities which are briefly as follows:

(1) Approval of sub-contracts for materials and sub-contractors.

(2) Preparation of specifications for materials and methods of testing and correlating these specifications with reference to Bridge and Road Construction so that all Bureaus would use identical specifications.

(3) Complete mill and shop inspection of all malleable castings, steel, bronze and similar materials.

(4) Laboratory investigations for materials used for special purposes, such as paint, waterproofing materials, aggregates, special devices or methods proposed for use in Bridge and Road Construction, etc.

(5) Co-operation with the Construction Engineers in the field in setting batcher plants and in obtaining proper temperature control for winter construction.

(6) Plant control of materials, proportions and mixtures of asphaltic concrete made by the County's own plants, or by a contractor's plant for the construction of bituminous wearing surfaces for Bridges and Roads.

(7) Drilling cores from all completed pavements to determine if proper depth of road slab has been obtained and making a report for the Allegheny County Controller in connection with his approval of the final estimate for payment.

In the inspection of materials one frequently finds that there has been a misunderstanding on the part of the producer of such

material, as to the requirements or purposes for which such materials are to be used. The rejection of unsuitable material is a negative activity, although it is frequently necessary. It is very much better for all concerned to prevent the manufacture or shipment of materials which do not meet the requirements. The full value of a Bureau of Tests and Specifications is, therefore, not reflected in the number of rejections made of unsuitable material, because with proper co-operation on the part of the Contractors and the Construction Engineers it is possible to eliminate the greater portion of misunderstandings which usually occur on large construction projects.

The specifications of Allegheny County require the Contractor to submit in writing, immediately after signing the Contract, information as to whom he proposes subletting any portion of a contract, whether for material or labor, or both. As soon as this information is furnished an Engineer in the Bureau of Tests and Specifications communicates with the Producers of the materials which the General Contractor proposes to use. If the source of supply is one which has already been used by the County the approval can be given at once. If the Producer is not known it is then necessary to make an inspection of the plant and equipment and discuss the County Specifications and Requirements with this proposed Sub-contractor. The writer wishes to emphasize the importance of this procedure. So far as we know there is no other municipality which investigates and approves every Sub-contractor for materials of every kind. Experience with several hundred contracts has led us to believe that this should be the first duty of any Engineer in getting a Job underway. There is no particular reason why the Engineer of a small city or borough who employs a commercial testing laboratory to do his testing-work should not follow out the same procedure before turning the work over to the Laboratory for actual testing and it also seems to the writer that this should be a very desirable activity for commercial testing laboratories to take up, in addition to their routine testing of materials on a given job. Needless to say the approval of such sources of supply must be unbiased and based solely upon the qualification of the Producer to furnish materials complying with the specifications.

After a mutual understanding has been obtained from which the Producer knows exactly what will be required and the consumer is satisfied that such a Producer can comply with his speci-

fications the actual inspection of the material becomes a secondary consideration. In dealing with the hundreds of reputable producers it has been our experience that most rejections are the result of a misunderstanding of the specification, rather than deliberate intent on the part of the Contractor to cheat. One can hardly conceive of a large foundry or rolling-mill attempting to deliberately produce a material not complying with a given specification, but rejections are necessary through misunderstanding on the part of some one and that person may be a prominent official or the laborer who fails to add copper in the ladle when copper-bearing steel is specified. It is the policy of the Department of Public Works to have the Inspectors and Engineers in the field endeavor to anticipate such difficulties. It is far better to call the attention of the Mill or Foundry to the fact that a specific kind of material is required before production starts than it is to let the material be produced and then reject it.

It is not the policy of the Bureau of Tests and Specification, nor the Engineers of the Department of Public Works, to act as detectives in the handling of Construction Work. It is far better to spend the necessary time to properly calibrate a set of scales on a batcher plant and thoroughly instruct the operator at the batcher plant as to the exact quantity of concrete aggregate to be weighed or measured and thus guarantee in advance that the correct proportions will be used at the beginning of the job than it would be to permit the Contractor to start work and determine by testing concrete specimens in the Laboratory that the strengths were lower than they should be and thereby create a controversy which can be prevented by preliminary work.

This does not mean that field control specimens are not taken daily from all concrete or bituminous materials being used, but such tests are for record and to assist in the detection of errors which are inevitable and in the improvement of the product through the information developed by means of such tests.

All Contractors are required by the Specifications to furnish two copies of their orders to Sub-contractors for materials and to state on such orders that—"This material must meet the requirements of Allegheny County Specifications and is subject to inspection by the Bureau of Tests and Specifications." A copy of this order is used by the Inspector in handling his work and the fact that the order calls for "inspection" leaves no loop-hole for the Producer to disclaim lack of knowledge concerning such requirements.

In the development of specifications for materials of every kind it is necessary to do a large amount of investigational work and this is usually done in co-operation with the Producer of such materials. For example—it was found desirable to construct bridge-railing with a non-rusting material, similar to cast iron, but of a greater physical strength. To this end, the co-operation of the local manufacturers of malleable cast iron was solicited and through their hearty co-operation it was possible to develop a casting which not only produced a very ornamental structure, such as our Liberty Bridge handrailing, but also the strength of such a handrailing was far beyond that of any which has been produced up to that time. Figure 1 shows the results of an acci-

FIG. 1.

dent to such a railing and in making the repairs it was only necessary to repair the steel facia girder and bend the malleable casting back into place. Such a handrailing was not used until extensive tests had demonstrated that it was superior to cast iron. Full sized posts were subjected to the impact of a "skull-cracker" without any serious damage and it is felt that the development of this type of railing has been a decided addition to the knowledge of handrail construction. In the same way, extensve investigations have been made for determining various designs of wire rope barriers. Some of these tests were made by the Pennsylvania Highway Department and the U. S. Bureau of Public Roads and witnessed by Engineers of Allegheny County. In other words, all

sources of information are used in the preparation of specifications for County Work.

At the present time a comprehensive series of tests is being conducted by the U. S. Bureau of Public Roads, at the request of Allegheny County, for the development of a lighter type of bridge floor slab construction. If these types of floor prove satisfactory it will mean a saving in weight of materials used in the entire bridge.

In approving the source of supply of aggregates used in concrete construction it is necessary to know the actual quarry from which a material is to be obtained. Allegheny County, and certain adjoining Counties, are known to have limestone quarries which are unsound and not suitable for Highway Construction. In approving the source of supply from a new quarry an extensive examination is made and samples taken to the Laboratory for a series of tests to determine their suitability for paving construction and also as to their durability. Failure to do this has been responsible for many projects which have disintegrated in various parts of the country. Figure 2 shows a retaining wall on

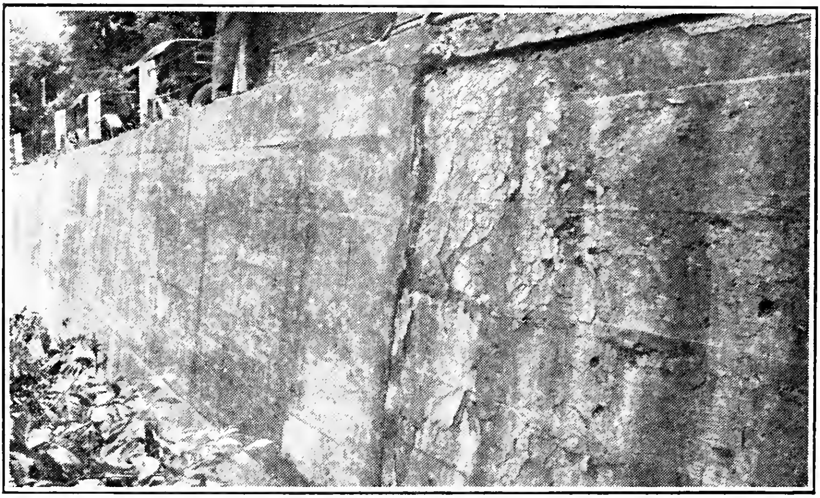

FIG. 2.

a State Highway made with unsound limestone in one section and sound and durable limestone in the adjacent section. This wall was constructed in 1920 and all of the materials, methods of construction, etc. were identical, with the exception that after the testing the Engineer decided that the limestone which was being used was unsound and the source of supply was changed. The illus-

tration shows very clearly the failure of one portion of the wall after a few years and certainly justifies the opinion of the Testing Engineer who condemned the original source of supply.

It is not meant to infer that such limestone is found in many locations but the fact that such an occurence is rare makes it all the more important that in approving a source of supply the Engineer knows definitely that the materials are suitable and durable. A petrographic analysis was made of this particular quarry and the examination showed that the presence of Beidellite, which is a clayey material, would account for the lack of durability in this stone. A chemical analysis, or the ordinary physical tests, did not furnish the information that this stone would not be durable in service.

It has been found necessary for us to refuse approval of two quarries because the stone is unsound, although these sources of supply are within easy shipping distance to Allegheny County.

Having made the necessary research to enable the Engineers to prepare satisfactory specifications for the given project and obtained copies of orders from the Contractor showing that the materials are to be purchased from approved and capable sources of supply the actual inspection of the materials and methods of construction begin.

The Resident Engineer in the field is furnished with equipment for testing aggregates at the batcher plant, as shown in Figure 3. This work is done by a representative of the Resident

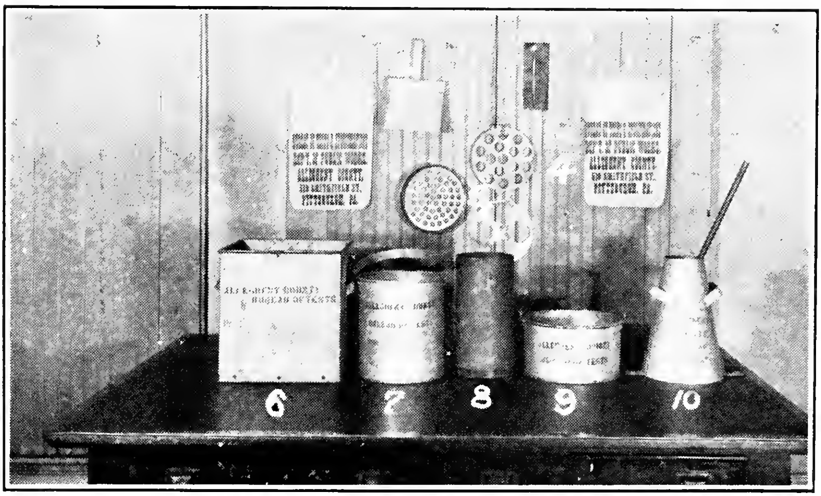

FIG. 3.

Engineer, who is located at the batcher plant, and is further supervised by a traveling inspector, working under the Construction Bureau and co-operating with the Testing Laboratory. In case of controversy samples are taken by a representative from the Bureau of Tests and Specifications and delivered to the Laboratory for complete tests.

Wherever possible materials are inspected and tagged at the source of supply. Steel is stamped at the rolling-mill and in the fabricating shop. Reinforcing bars are inspected at the mill and tagged with seals which indicate to the Engineer in the field that the material has been approved. The Resident Engineer also receives copies of all reports so that he has knowledge as to the material which has been inspected and approved. Copper bearing steel is used in all of Allegheny County Bridge Construction on account of its rust-resisting quality.

Portland Cement is inspected at the Mills and where it is shipped by truck each bag carries a small piece of ribbon-tape bearing the printed words "Allegheny County."

FIG. 4.

All paving brick are tested and inspected at the Plant of the Manufacturer and the car labelled by the Inspector at time of shipment.

It is not necessary to tell a body of Railway Men anything about methods of inspecting steel or castings in the fabricating shops. Our very best Inspectors who are handling the Bridge work in the shops for Allegheny County received their training with the railroads and commercial testing laboratories.

All paint used by Allegheny County is subject to inspection at point of manufacture. The materials are selected and brought to the laboratory for chemical analyses. If satisfactory, these materials are then correctly proportioned and ground in the presence of a County representative. The finished paint is placed in the container and labelled with seals, as shown in Figure 4. When the paint arrives on the job the container must carry these labels or it is not accepted by the Resident Engineer.

It is not possible to go into the details for the inspection of the hundreds of materials used in our building program. Those which are given serve to illustrate the methods employed.

Before a paving project starts the Engineer in the field requires the Contractor to have various kinds of equipment necessary for the work. Subgrade testers are required to insure a true and uniform subgrade. The strike-off templet must be prepared in advance if a power-finishing machine is not to be used. If the subgrade is true and uniform and the surface of the road is correct the depth of the pavement should be strictly in accordance with the Contract Plan, but in addition to these requirements the completed pavement is subjected to core-drilling tests which determine the actual depth of the pavement. These cores are taken for every 2,000 square yards and the depth of the pavement measured. These cylinders are also taken to the testing laboratory and crushed to make a final record as to the strength of the concrete actually obtained in the pavement. These records are available to any one who is interested in Highway Construction. The results of the core-drilling depth tests are tabulated and sent to the Controller of Allegheny County for his information before the final estimate is paid. The specifications permit a variation of one-fourth inch in depth with a reduction in price for any amount in excess of one-fourth inch and not exceeding one-half inch. This deduction is so great that the Contractor would find it very unprofitable to use an uneven subgrade. If

a core is obtained showing a depth less than that required additional cores are taken at intervals of fifty feet in both directions in order to determine the area for which the reduction price shall obtain.

The traffic conditions frequently are such that it is very important to open a section of road, or an intersection, at an early date. The pavement slabs have a depth based upon standard requirements for Highway Design and in order to determine if

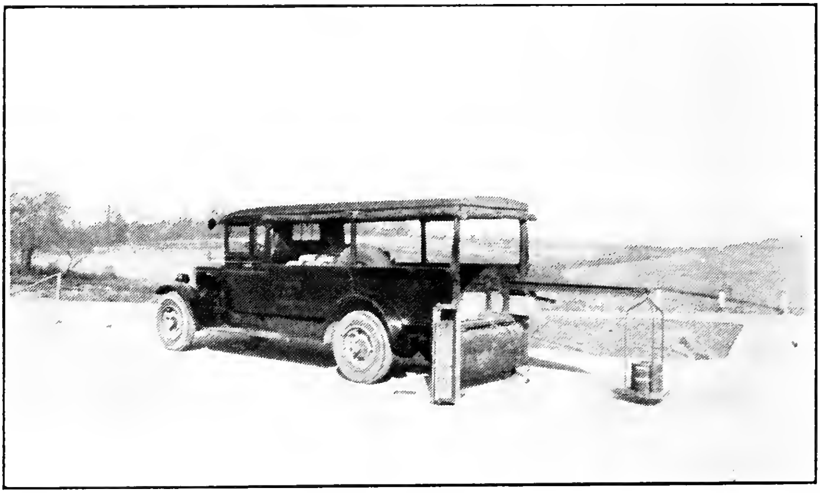

FIG. 5.

such requirements have been complied with, concrete beams are made in the field in steel moulds having inside dimensions 6x8x40 inches. These beams are cured under conditions identical with the pavement and when it is found desirable to open a section of the pavement a truck is sent from the Bureau of Tests with a beam-breaking machine which makes the test in the field in the presence of the Resident Engineer. Figure 5 shows this beam-breaking machine in operation. The modulus of rupture is determined from this test and from the chart, as shown in Figure 6, the weight of vehicle which may be permitted to go over the Road is ascertained.

In order to have a record of all projects and keep the materials properly identified each project is given a Job Number at the time the Contract is let. This Job Number is placed on all tags or reports in connection with that particular Job throughout its entire period of existence. This greatly simplifies the identification of samples from Jobs which may have similar names and

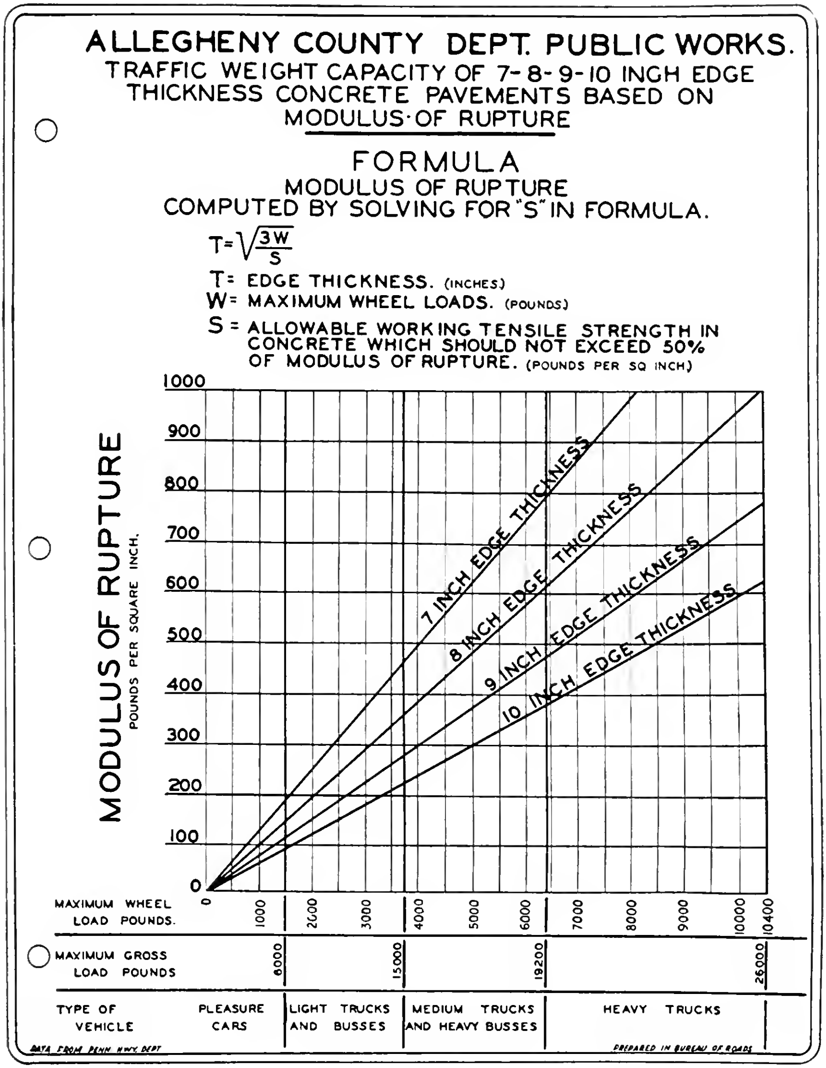

FIG. 6.

Contractors, and it is possible to place such numbers on metal tags with very little trouble. These metal tags are suitable for marking concrete cylinders and beams or other material exposed to the weather.

The five Allegheny County Asphalt Plants are equipped with recording pyrometers and thermometers which make a permanent record of the temperatures of the various materials used in making asphaltic concrete. All materials, such as bitumen, stone and sand

are tested and approved before being incorporated into the work. A Field Laboratory is located at each County Asphalt Plant and a portable laboratory is always set up at the plant of a Contractor if he is doing work for the County. Such equipment enables the Inspector to know in advance the quality of the materials to be used and from the information obtained he is able to set the weighing devices to obtain the exact amount of materials called for under the Specifications.

In this paper it is only possible to briefly outline the methods used in the preparation of specifications and the necessary investigation to develop suitable specifications for various purposes. It is vitally necessary that harmonious co-operation exist between the Resident Engineers in the field and the Testing Department. It is a great pleasure to say that such co-operation exists between the various Construction Bureaus of the Department of Public Works and the Bureau of Tests and Specifications, and it is through this mutual understanding that it has been possible to handle the hundreds of construction projects in a manner which we believe to be satisfactory to the people of Allegheny County who are familiar with the work being done. The Engineers in the Department of Public Works are Members of various Technical Societies, and are permitted to attend Committee Meetings of Engineers throughout the country. The information obtained from such meetings is disseminated throughout the County Organization for the benefit of Engineers who are in need of such information, and thus it is possible to keep the Specifications and Methods of Construction abreast of the latest practice in Bridge and Highway Construction.

Specifications are also written for some of the Departments outside of that of Public Works and we are testing such materials as: Flour—Blankets—Non-rusting Soup Kettles—Water Softening Plant—Boilers—Tarpaulins—Rope—Blueprint Paper—Red Dog, etc. Right now we would like to have a good Specification for Nails.

PRESIDENT: I am sure we have all enjoyed this discussion very much, and we are honored in having with us tonight the man who has been Mayor of the City of Pittsburgh and is now a County Commissioner and the father of this Bureau of Tests. At this time I am going to call upon Mr. Armstrong to say a few words to us.

HON. JOSEPH G. ARMSTRONG (Chairman, Board of County Commissioners of Allegheny County). Mr. President and Members of The Railway Club of Pittsburgh:

After hearing all you have heard, I do not know whether I can add anything or not. But you can see that I as a layman am up against a lot of Browns and Freemans and others just as smart, and I have to watch them very carefully. After putting in four years and a half as Director of the Department of Public Works of the City of Pittsburgh and eight years in my present office, there are a lot of things I learn that do not come out of books. Therefore I have to watch these book-learned gentlemen. And I do.

I do not know a thing that I could say that would interest you, because you have seen this work. We have done a lot of work in Allegheny County. I might say to you that up to 1924 you never had an engineering organization in your County, not an organization that could build a Fortieth Street Bridge, or a Sixteenth Street Bridge, or the Liberty Tubes and any other similar structure. These were done by outside organizations. However we organized an engineering department, and we did not handcuff it in any way. Every man that works in this department is a technically trained person and they all have to pass Norman Brown before they can be employed. We do not say he is employing them, but the best engineer in Pittsburgh could appeal to Joe Armstrong, the Chairman of the Board, and he would not be given a job if there was a vacancy. He has first to go to Norman Brown, and if he can satisfy Norman Brown, I am satisfied. There is no politics in Allegheny County, but I will say that where a technical or a specially trained person is needed to fill a position, no politics influence his selection. You could not build bridges, you could not build tubes, you could not build boulevards with the fellows that you would pull off the sidewalks. You have to have one educated along that particular line. And we give our Department of Engineering, with Mr Brown at the head of it, full sway in that line.

We have done a lot of work. In 1924 you gave us $29,206,000. We spent it, and we believe we spent it right because when we came back in 1928 for more you gave us $43,680,000. Of this amount, $37,000,000 worth of jobs have been completed or are in the hands of contractors.

Allegheny County has, through the channel of her bonding

power, issued $91,000,000 since 1924. There is a reason for this large expenditure. Allegheny County had been asleep for the previous twenty or thirty years. There was more work done in Allegheny County in the last seven years than there was in a hundred years before that time. It was unreasonable to think that it should be necessary in that short period of time to spend that much money on improvements in your County, but we had to do it for the reasons I have already stated. The men in office prior to that time did not appear to have the nerve to go to the people and ask for the finances to do something. Four out of every five men elected to office were cowards. They were afraid to ask their constituents for the finances to build the Liberty Bridge or the McKees Rocks Bridge or the Ohio River Boulevard. They wanted to be re-elected and they were not taking any chances by incurring the expenses involved in making these enormous improvements.

We have spent $91,000,000 of your money. Now the County Commissioners have to provide the money; that is all they have to do. But though we had all the money in the County, we could not have done this work without the technical men. We could not have solved the different problems that were put up to us without them. We could not draw the plans and specifications for a Liberty Bridge. The holes would not meet and the rivets would not go through, and we would have all sorts of trouble. We could not build a tunnel any better than we could build a bridge.

The great State of Pennsylvania has spent a lot of money in building state roads and Mr. Brown knows the extent to which we have aided the State Department—$6,000,000 to $7,000,000 was contributed by Allegheny County to help build roads that are now called State Highways. On every road that was built up until two years ago, that was more than 16 feet wide, Allegheny County paid for the extra width, the property damages and built the bridges on them. I might say that the County of Allegheny contributed to the State of Pennsylvania over 1¾ million dollars for the Lincoln Highway and Westinghouse Bridge project. The bridge was designed and is being built by us; the road is being built by the State of Pennsylvania.

We built sixteen river bridges in Allegheny County in the last seven years, costing from $1,125,000 to $7,500,000. We built 75 bridges in Allegheny County during the last seven years run-

ning from $10,000 to $350,000. In otherwords we built 91 bridges, some of them replacements; some of them new bridges. We built 150 miles of boulevards and new roads. We have resurfaced highways and eliminated dangerous crossings and eliminated dangerous curves to the extent of 350 miles, costing $39,000,000, and your bridges cost about $40,000,000.

We want you citizens and taxpayers when you leave Allegheny County and go to Cleveland or Detroit or Baltimore, to hold up your heads and say with pride that you come from Allegheny County. We have as good conditions in Allegheny County as there are any place else in the United States. Our improvements cost us a lot of money. For example, in building our Airport we were not like Cleveland or Detroit, where they could go out and look over a level country and make a choice. In building the Airport in Allegheny County we moved 3,000,000 cubic yards of dirt, tore down mountains and filled up valleys. You do not have to do that in these other places. And the great element of cost in building roads in Allegheny County is moving the dirt. Our contractors can lay concrete just as inexpensively as they do in Cleveland or Detroit, but when we have 100,000 yards of dirt to move, that is a different story to tell. That is why your expense is higher than those other places.

I can tell you that you have 408 bridges in Allegheny County. Every one of them has to be kept up. Every one is different, as a rule, from other bridges in other localities. Excessive loads are going over bridges built for horse-drawn vehicles. Therefore it is necessary to replace them to meet present conditions and carry that which it is now necessary to carry—not 5 or 10 tons—but 25 or 30 tons.

I am not here to make a speech. I would not know how to make one if I wanted to. But we have spent a lot of money and I am glad Mr. Freeman has shown you these pictures.

I am glad to be with you. I have been dealing with engineers a good many years and I want to say that they are human. However it does not do a bit of harm to watch them. I have always had good men, every one of them. But coming from an Irish ancestry I have a little of that suspicion about me all the time; therefore I watch Brown and all his clan. And it is a clan all right. They like one another. But we never had an engineering department in Allegheny County until Mr. Brown took charge of that, and he is able to surround himself with men like these, and

as far as the Board of County Commissioners is concerned, we never interfere. We let the technical men have a free hand in the construction of bridges, roads and buildings, and ask that they present something to the general public that they approve, and that means something to me. I thank you.

PRESIDENT: We thank you, Mr. Armstrong, for that talk. Now I am going to call on Mr. Norman F. Brown, Director of this Department that we have heard so much about tonight.

MR. NORMAN F. BROWN (Director County Department of Public Works). Mr. President and Members of the Railway Club:

I have enjoyed this evening very much, but I want to say that there has been a little too much Brown in the remarks of both Mr. Freeman and the Commissioner.

In the latter part of December, 1923, Mr. Armstrong and one of his very prominent colleagues asked me if I would undertake to organize a Department of Public Works. I asked him one question. "Do you want a department to do construction work and do you want to reorganize so that you can do a lot of construction work?" He said, "We want to get out a bond issue and we want a department adequate to handle it."

Now it is easy to organize a department when you are given a free hand. Mr. Armstrong has never appointed one single technical employee in the Department of Public Works. Mr. Armstrong and the Board do appoint watchmen and laborers, but every technical man we have on our staff which builds the tunnels and bridges and everything of that kind has been appointed, not by me, but by that bureau head, and he is held responsible for that appointment. There has never been any political significance in the appointment of any man in any of these departments that do the actual designing and making of plans and the supervision of the work. It is true we have inspectors in our corps but they are not in responsible charge in any way of any of the work we have under way.

At the time we were organizing, I told Mr. Armstrong that we must have something no other municipal organization had—that was a Test Bureau and a Specification Department. He said, "Go ahead and fix it up." And I looked around and found Mr. Freeman, and after I talked with him he said he would come over and organize, build and operate a laboratory and test

all our materials. At the present time he tests gasoline and oil and wire rope and locust posts—he tests everything. He says he knows, and he looks wise, and I consider that he is my boss in respect to the Testing Department. He is also the boss of every other department head in respect to specifications. There isn't one of our bureaus, whether maintenance of equipment, roads, bridges, or anything else, that can specify anything and use it until he has said yes or no. That is why we get the very best materials that can be obtained. Freeman had not been in this department three days before he got the Commissioners to give him $38,000 to build a laboratory. It is all right to say that I did this or Mr. Armstrong did that, but that department was passed upon by myself the same as our Bridge Department or Road Department, or all those departments.

We have built a new office building and now are located at the corner of Ross and Diamond Streets, in wonderfully fine quarters. Our entire organization is in that building. That front door is open to any of you at any time. There is not a book or plan or anything in that building that is not open to the public. I am now extending you an open invitation to walk into the building at any time and look around and you will find everything open to you. Come in and look it over.

We have an exhibition room on the first floor and in it there is on display an interesting model of the Airport. We want you to see that. From time to time we will display other exhibits of projects which we are building. They are deserving of your attention and we want you to get acquainted with them. A man is in charge there who will demonstrate the equipment and the use of it. This is all the contribution of Commissioner Armstrong, who, starting in 1923, brought all this up to the standard which we have today. He said $91,000,000 had been spent. When the present work under way is completed, it will amount to a little over $100,000,000 since January 1, 1924. We have $40,000,000 of work under way at the present time. You do not see it in the newspapers because they do not publish it. Two weeks ago we opened bids for 1¾ million dollars worth of work; four weeks ago for 1½ million dollars; at present we have contracts being advertised for one million. This should help the great army of unemployed. In our department one day's pay was contributed by the employees for the unemployed and it amounted to $12,000. We are doing more for the unemployed than any municipality

I know of in the United States in the construction work we have undertaken. We are going to keep all the work going. I cannot say anything further than that. Mr. Armstrong covered the whole situation very fully, and so did Mr. Freeman. Some time if you would like to know more about bridges and roads and the Airport, we would be glad to tell it to you. Come to the building and see what is going on and I assure you it will be an education for all of you. I thank you, gentlemen.

PRESIDENT: We thank you, Mr. Brown. We will now throw the meeting open for a general discussion, or for any questions any of you may wish to ask.

MR. FRANK J. LANAHAN: The talk by Mr. Freeman tonight has been instructive and enjoyable. One feature that probably due to modesty was not mentioned by either Mr. Armstrong or Mr. Brown, that is an outstanding accomplishment, was the awarding to Allegheny County, the national prizes for the most artistic bridges erected during the year in the United States. This should be a matter of pride to all our citizens.

Seeing, too, is believing, and those of us who travel around the country cannot help but realize how Allegheny County has led in public construction. Our roads are most delightful, our bridges and tunnels cannot help but accrue to the utmost for the benefit of the general community. I for one, as a taxpayer, feel that we are getting results in connection with this work that are in keeping with the expenditure, and, as Mr. Armstrong has said, the great amount of work which has been done is more in the last seven years than in the hundred years preceding, and has met the general approval of the people.

Mr. Freeman's talk was particularly interesting to a number of us here this evening, who came in contact with him and his able assistants officially, in supplying malleable iron railings for the Allegheny County Department of Public Works. The fairness, the consideration and the helpfulness that were shown by Mr. Freeman and his corps, have left with us a lasting impression.

The old adage that "a stitch in time saves nine" is particularly applicable to Mr. Freeman's policy, and his theory if you get started right you have the minimum of difficulty. The intelligence, the knowledge and the integrity with which the tests were conducted gained our wholehearted admiration and tonight is a good time to express the gratitude of the Fort Pitt organization

for the equitable treatment of which we were recipients from Director Brown and his entire staff.

I realize that the hour is late and the chef has set out the material for the entertainment of the innerman, and it would be hard to compete with this treat, yet I feel we would all be compensated for holding the lunch in abeyance for a few moments that we might become acquainted with the heads of the different divisions composing the Department of Public Works of Allegheny County. I am actuated in proposing this, because the membership in the Railway Club is made up of citizens from all over the county and embraces in its ranks not only officials of railroads, but workmen, clerks, men from the car shops and others out on the line. It is a cosmopolitan assembly, and we would have them carry back to their respective homes, a resume of what they have heard here from authorative sources and prove the benefit to the various communities in which they reside. May I ask you, Mr. Brown, to kindly present to the meeting, the members of your staff?

Mr. Brown thereupon introduced the following members of his staff, who responded briefly:

Mr. Edward Schmidt—Chief Engineer of the Bureau of Roads.

Mr. A. D. Nutter—Chief Designer of Bridges.

Mr. Reuben Helick—Chief of the Bridge Maintenance Department.

Mr. Earl Kaltenbach—Engineer in charge of special studies.

Mr. F. W. Groh—Assistant Chief Engineer Bureau of Tests.

Mr. C. W. Betz—Chief Chemist of Bureau of Tests.

MR. FRANK J. LANAHAN: That is a fine aggregation, Mr. Brown, and well may you be justly proud of your co-workers. They all manifest an intimate knowledge of the work they are doing and I think we all here tonight who heard Mr. Armstrong will agree with his statement that in your Department, ability is the sole determining factor in selecting employees. Mr. Freeman's talk has given us information concerning our own community, the magnitude of its scope and the proficiency in accomplishment, and I would move you, Chairman, that the Railway Club of Pittsburgh show their appreciation of Mr. Freeman's courtesy in appearing before us, and this be done by all rising as a vote of thanks.

PRESIDENT: Mr. Freeman, we all appreciate very highly your coming here tonight.

MR. FREEMAN: It is a great pleasure to be here.

PRESIDENT: This is the last meeting before the summer vacation. Our next meeting will be in September. I hope you will all have a pleasant vacation and be back for our first meeting next fall.

There being no further business, on motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

W. R. WILSON,

Died, April 29, 1931

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OFFICIAL PROCEEDINGS

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The Place for the Oil-Electric Locomotive in Modern Railway Transportation

By WILLIAM F. KROMER, Designing Engineer, H. K. Porter Company, Pittsburgh, Pa.

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OF

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Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

September 24th, 1931

The meeting was called to order at the Fort Pitt Hotel at 7:00 o'clock P. M. Eastern Standard Time, with President L. E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Allen, Harvey
Allinger, N. J.
Allison, John
Altsman, W. H.
Ambrose, W. F.
Ashton, William A.
Askin, J. A.
Babcock, F. H.
Balzer, C. E.
Barr, H. C.
Beam, E. J.
Berg, Karl
Berghane, A. L.
Brinkhoff, W. H.
Buffington, W. P.
Burel, W. C.
Carr, T. W.
Carson, John
Christy, F. X.
Conway, J. D.
Cotter, G. L.
Croke, Thomas F.
Cunningham, R. I.
Dalzell, W. E.
Davis, Charles S.
Diven, J. B.
Dunbar, Harold F.
Durkin, James E.
Earley, J. T.
Edwards, C. H.
Emery, E.
Emsheimer, Louis
En Dean, J. F.
Endsley, Prof. Louis E.
Falkner, A. J.
Fenton, H. H.
Flinn, R. H.
Forsberg, R. P.
Frauenheim, A. M.
Frauenheim, P. H.
Freshwater, F. H.
Fry, L. H.
Fults, J. H.
Gardner, George R.
Gatfield, P.
Geisler, Joseph J.
Gilg, Henry F.
Glessner, G. P.
Gorman, Charles
Haller, Nelson M.
Hamilton, Hugh M.
Hansen, William C.
Harper, G. C.
Hastings, W. S.
Hilstrom, A. V.
Holmes, E. H.
Huber, H. G.
Hughes, John E.
Huston, F. T.
Johnson, A. B.
Kelly, L. J.
Kirk, W. B.
Kirkpatrick, R. L.
Lanahan, Frank J.
Laughner, C. L.
Laurent, Joseph A.
Lee, L. A.
Lehr, H. W.
Lobez, P. L.
Loeffler, George O.
Longdon, C. V.
Ludgate, B. A.
Lynn, Samuel
Mayer, L. I.
Meyers, William F.
Millar, C. W.

Miller, J.
Mills, C. C.
Misner, George W.
Mitchell, F. K.
Mitchell, W. S.
Morgan, Homer C.
Moses, G. L.
McGeorge, D. W.
McIntyre, R. C.
McKenzie, Edward F.
McKinley, John T.
McNamee, William
Nagel, James
Nash, R. L.
Noble, Jesse S.
Orchard, Charles
Painter, Joseph
Pickard, S. B.
Posteraro, S. F.
Pringle, H. C.
Pringle, P. V.
Pugh, A. J.
Reeve, George
Renshaw, W. B.
Rizzo, C. M.
Rushneck, G. L.
Saltic, Thomas
Sattley, E. C.
Schaffer, W. E.
Schmitt, Raymond F.
Schrader, A. P.
Schultz, D. C.
Seibert, W. L.
Severn, A. B.
Shellenbarger, H. M.
Sheridan, T. F.
Simons, P.
Smith, J. Frank
Snyder, F. I.
Sterling, C. C.
Stevens, L. V.
Stevens, R. R.
Stucki, A.
Sutherland, L.
Thomas, H. N.
Thomas, Theodore
Trautman, Harry J.
Van Vranken, S. E.
Vollmer, Karl L.
Wheatley, William A.
Wikander, Oscar R.
Wildin, G. W.
Winslow, S. H.
Woodward, R.
Wright, O. L.
Wurts, T. C.
Wyke, J. W.
Wynne, F. E.
Yarnall, Jesse

VISITORS

Aaron, Paul S.
Candee, A. H.
Carruthers, G. R.
Dunham, C. W.
Fralic, C. F.
Glaister, T. W.
Gollmer, H. C.
Gurmirdt, H. E.
Harper, Kenneth
Hereley, James E.
Herley, J. E.
Hunsberger, T.
Justus, I. J.
Kentlein, John
Krepf, H. C.
Kromer, William F.
Lewis, S. B.
Manzey, Paul H.
Mitchell, Paul L.
Mullooly, C. J.
Neely, E. M.
Parks, H. E.
Pearson, A.
Schenck, S. B.
Schrontz, S. B.
Scott, H. B.
Siner, Thomas E.
Smith, Robert B.
Smith, Sion B.
Stewart, W. D.
Tripp, W. N.
Trottnow, E. H.
Vollmer, Walter K.
Warren, E. T.

Wheatley, Albert R.	Williams, S. L.
Williams, E. A.	Wilson, J. R.

The calling of the roll was dispensed with, as a full record of the attendance is shown on the registration cards.

By common consent the reading of the minutes of the last meeting was dispensed with as the Proceedings have been published and distributed to the members.

The Secretary read the following list of applications for membership:

Joyce, P. H., President, Standard Steel Car Corporation, 79 East Adams Street, Chicago, Ill. Recommended by Frank J. Lanahan.

Kromer, William F., Mechanical Engineer, H. K. Porter Company, 108 Tenth Street, Aspinwall, Pa. Recommended by L. E. Endsley.

Siner, Thomas E., Camden Forge Company, c/o William Penn Hotel, Pittsburgh, Pa. Recommended by Henry F. Gilg.

Smith, Robert B., Transportation Sales Department, Westinghouse Electric & Manufacturing Company, 1504 Marlboro Avenue, Wilkinsburg, Pa. Recommended by R. L. Kirkpatrick.

Stewart, K. C., Chief Engineer, Canton Car Company, 410 Werner Road, Canton, Ohio. Recommended by Bruce B. Stamm.

Wilharm, John, Traffic Manager, Diamond Alkali Company, 517 East End Avenue, Pittsburgh, Pa. Recommended by L. E. Endsley.

PRESIDENT: These names will be referred to the Executive Committee, in accordance with out By-Laws, and upon approval by them the gentlemen will become members without further action of the Club.

SECRETARY: We have received information since the last meeting of the deaths of the following members: C. H. Forrest, Foreman, P. & L. E. R. R., died July 26, 1930; William F. Greene, Assistant to Engineer Maintenance of Way, Pennsylvania Railroad, died July 6, 1931, and William H. Jacobs, Crew Dispatcher, P. & L. E. R. R., died April 14, 1931.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

This is the meeting at which our By-Laws require the appointment of a Nominating Committee to make nominations for officers to serve the Club for the ensuing year. I will, therefore, appoint the following gentlemen as members of that Committee: Messrs. E. Emery, L. A. Lee and Charles Orchard. I will ask the Committee to meet and make report before the close of the session.

Is there any further business that should come before the meeting at this time? If not, we come to the paper of the evening. The speaker is Mr. William F. Kromer, Designing Engineer of the H. K. Porter Locomotive Company, who will address you upon the subject, "The Place for the Oil-Electric Locomotive in Modern Railway Transportation." We are glad indeed to welcome Mr. Kromer here tonight to give us this talk on the locomotive.

The Place for the Oil-Electric Locomotive in Modern Railway Transportation

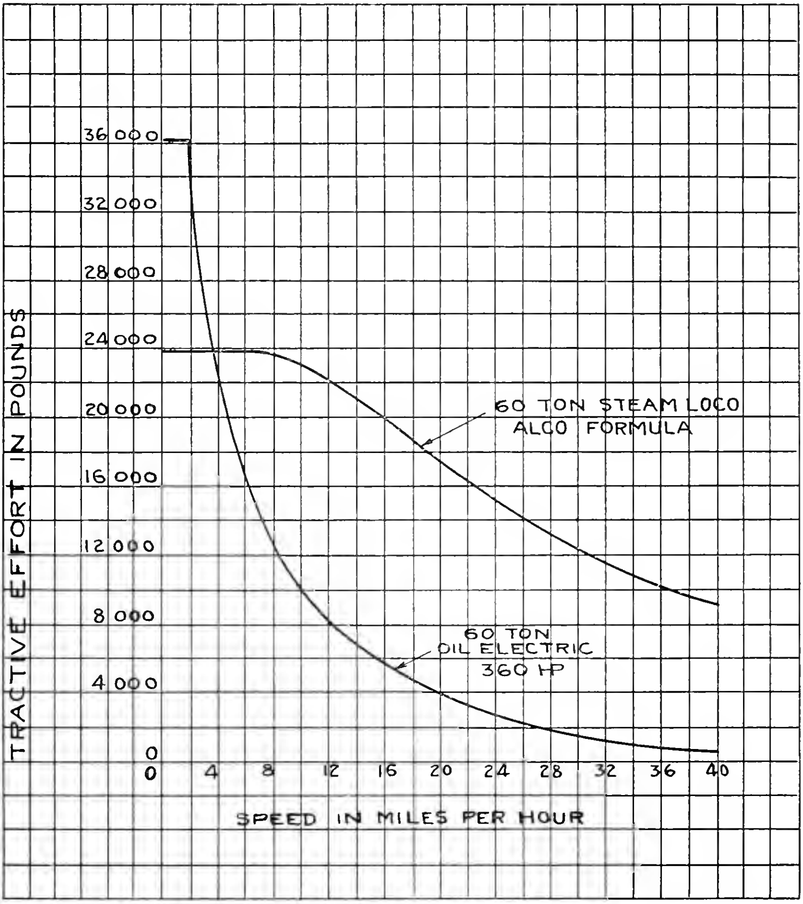
By WILLIAM F. KROMER, Designing Engineer,
H. K. Porter Company, Pittsburgh, Pa.

Many years ago, when the first electric locomotive had successfully demonstrated its adaptability for railroad service, the prediction was made that the steam locomotive would soon be a thing of the past. Some of you may have heard a similar prediction when success first marked the entrance of the oil-electric locomotive into the field of modern transportation.

We all know that this neither has happened in the first case nor will happen in the other, but we claim that there is a place in modern railway transportation and in industrial plants which an oil-electric locomotive can fill more economically and effectively than a steam locomotive.

To find a place where an oil-electric locomotive can be used to advantage we shall first consider the performance curve of an oil-electric and a steam locomotive approximately the same weights. The drawing shows the performance curve of a 60-ton oil-electric powered with two 180 H.P. oil engines and of a 60-ton steam locomotive with 18″x24″ cylinders, 50″ drivers, 180-lbs. boiler pressure and 23,790 tractive force. The figures on the horizontal line indicate the speed in miles per hour, and the figures on the vertical line indicate the tractive effort in pounds.

You notice the oil-electric locomotive has a much greater tractive force than the steam locomotive at low speed, but at high speed the tractive force of the steam locomotive is much greater.



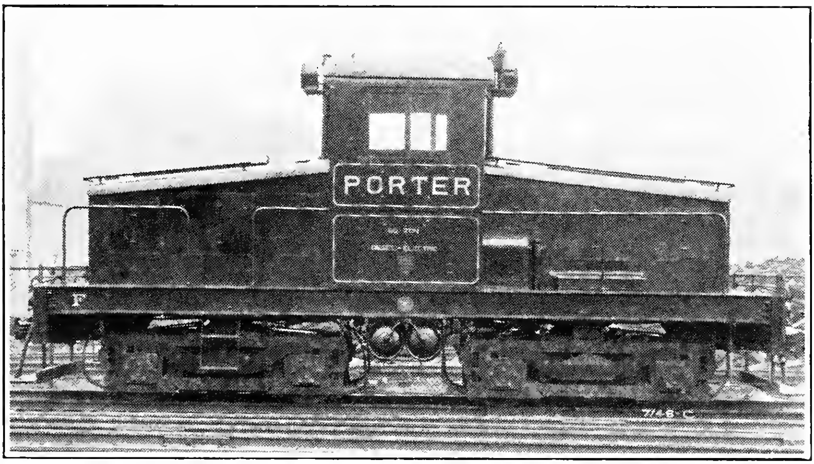
In usual switching service the high speed of the steam locomotive is ordinarily not required, but the high tractive effort of the oil-electric is decidedly advantageous.

The steam locomotive has the characteristic that it develops low horsepower at slow speed—it increases its power as the speed increases. The oil-electric locomotive, on the other hand, has a limited available horsepower fixed by the size of its engines. This power can be utilized over the greater part of its speed range. A variable electrical efficiency effects this to some extent, but in this discussion we will neglect it. Knowing these fundamental char-

acteristics, we can readily see for which type of service each locomotive is best suited.

To move a train requires a certain amount of horsepower, which depends on the speed at which the train is hauled. The train resistance, based on its tonnage, remains fairly constant in the ranges of speed which we shall consider, so that with a constant rate of acceleration, the tractive effort required also will be constant. Then the horsepower required will vary in proportion to the speed, since the product of force times distance per unit of time can be converted into horsepower. Thus, to accelerate a train at a constant rate requires little power at first but considerable power at high speed.

Let us take, for example, the 60-ton, 360 H.P. oil-electric locomotive. This locomotive can develop a much greater tractive effort at the start than a steam locomotive of the same weight; therefore, it will accelerate faster. As the speed increases, however, the power of the oil-electric cannot increase. The rate of acceleration drops off rapidly and soon becomes zero. This will occur at a comparatively slow speed, since the product of speed and tractive effort, properly converted, cannot exceed 360 H.P. On the other hand, the power of the steam locomotive increases as its speed increases. The 60-ton steam locomotive can develop about 900 horsepower at a speed of 20 miles per hour, provided the boiler can generate the necessary amount of steam. The rate



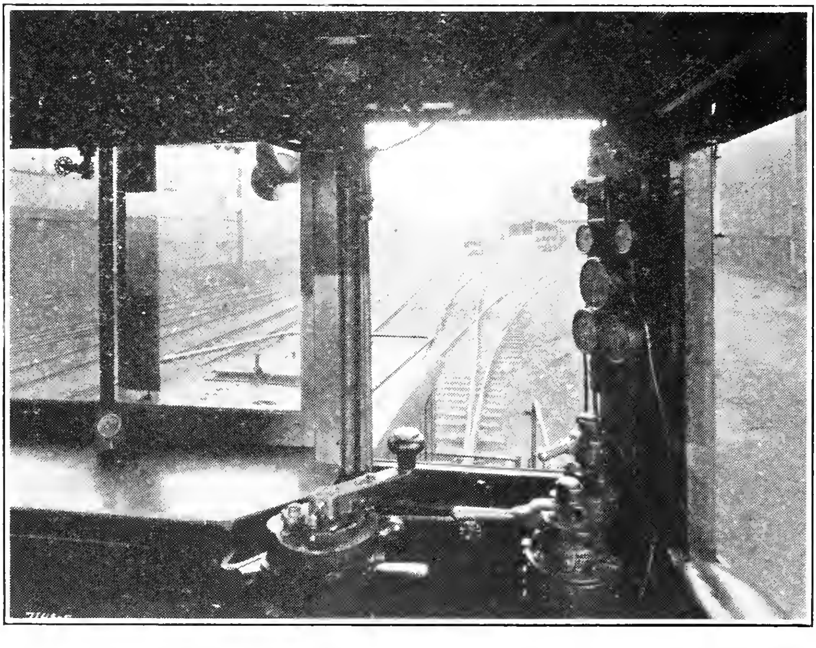
Side view of 60-ton, 360 H P. Diesel electric locomotive.

of acceleration drops off slowly and becomes zero at a comparatively much higher speed.

From this it is evident that an oil-electric locomotive of 360 H.P. can do a considerable amount of short, fast switching, due to its rapid acceleration and ease of handling. For a long haul at high speed or a heavy pull on grades, an oil-electric locomotive of much larger size would be required to equal the running time of the 60-ton steam locomotive. Each type of locomotive has limitations in application.

Just as the steam locomotive is limited in performance by its boiler capacity, so the oil-electric is limited by the thermal capacity of its equipment.

For each generator and motor there is a continuous current rating. This means that the machine may be operated continuously with the stated current flowing through it without overheating. Higher currents may be passed through the machine for short periods, provided there are enough low current periods so that the average effective heating current does not exceed the continuous rating.

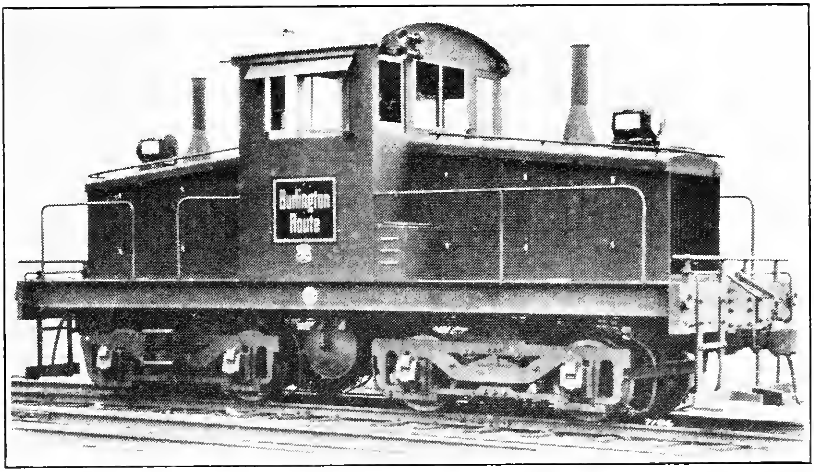


View showing visibility from operator's station on 60-ton Diesel electric locomotive.

Therefore small sized electric equipment may be used on a switching locomotive which alternates a number of short, quick accelerations with periods of idleness; but this equipment will not be suitable for long heavy hauls.

On account of the thermal capacity factor as described above, the total horsepower rating of the electric motors of the locomotive may often appear to be out of proportion to the power the oil engine delivers.

Next to suitability, cost will be the paramount factor in influencing the selection of the type of locomotive. Compared with a steam locomotive of equivalent weight, the first cost, depreciation, and interest charges of an oil-electric locomotive are much



45-ton, 330 H.P. gasoline electric locomotive.

higher. There are other considerations, however, which minimize and often more than overcome the difference.

In average switching work an oil-electric locomotive can replace a steam locomotive of greater weight, and can handle more cars per hour than a steam locomotive of the same weight.

Savings accrue in the fuel and lubricating costs, which, together, run normally about one-third of the fuel, lubricating, and water expense of a steam locomotive in the same service.

The service of a regular fireman is not required.

Maintenance and hostling expenses are considerably less.

There are a number of other savings which are of a more or less indeterminate nature, such as track maintenance, reduction in engine house facilities, and availability.

All of these factors should be considered as definitely affecting the cost of an oil-electric locomotive, compared with a steam locomotive.

To summarize the points we have made, the determination of whether an oil-electric is suitable for application to any particular service, whether that service lies beyond its range, and finally, whether or not there is a place properly filled by the oil-electric only, hinges on the answers to these three questions:

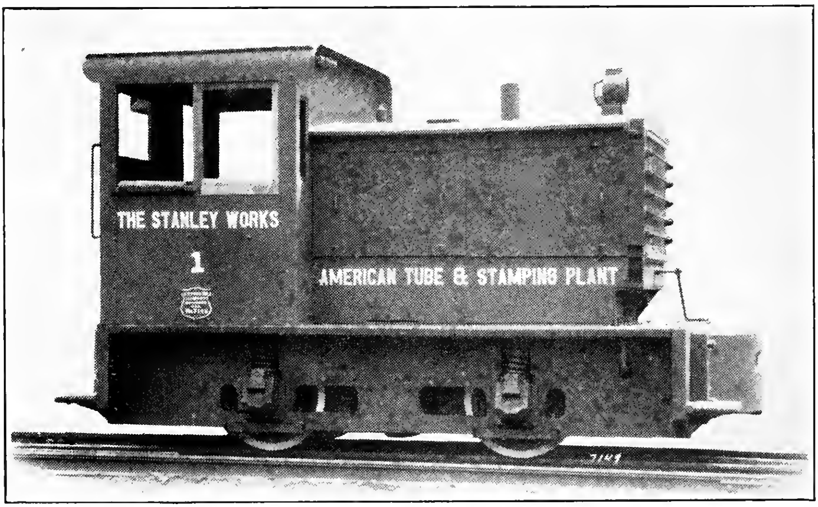
First—What power will be required?

Second—What duty cycle is involved?

Third—Will the first cost differential and the interest and depreciation charges be overcome within a reasonable time by the savings effected in operation?

In addition, other factors such as availability, visibility for operator, cleanliness, safety, elimination of noise, negotiation of sharp curves, and clearance limitations should be considered in the selection of motive power.

Everything we have said pertaining to the application of the oil-electric also applies to its kindred type of equipment—the gas-electric. The principle difference between the two is that the gas-electric has lower first cost and higher operating expense. For service in which the fuel consumption will be low and gasoline



15-ton, 110 H.P. gasoline electric locomotive, used in steel mill work.

relatively cheap, this type of equipment will prove more economical and equally effective.

The following types of service are generally considered by the operating departments as ones where considerable economies can be effected by internal combustion electric locomotives.

First: Outlying points or small terminals, where savings in fuel, ease of handling, no stand-by losses, and no water and water treatment costs, are involved; in labor, where fireman, overtime, labor due to hostling, ash handling, and engine watchmen would be eliminated; in maintenance—for instance, a gas-electric locomotive might have many light running repairs made by the engineman who might be paid a small extra amount per month over his usual rate for this service; no peddling and attendant fuel and labor costs, and less investment in engine house facilities.

Second: Economies can be effected by oil and gas-electric on branch lines where turn-around service is involved, such as in local freight, passenger, and mixed train service.

It has been found in one instance that a gasoline-electric locomotive can complete a round trip over a branch line in eight hours and perform switching service for the other sixteen hours at the junction point and the terminal, utilizing the locomotive twenty-four hours a day without terminal attention.

Third: Local branch passenger service or mixed runs where the passenger motor car is not suitable, and where the motor car could not do the way switching or the shifting at terminals.

Fourth: The swivel trucks of an internal combustion electric locomotive lend themselves readily to operation around the very sharp curves of many industrial tracks found at certain terminals, for which service a small steam locomotive not useful elsewhere must be maintained at high expense.

Fifth: Switching in warehouses and shops where cleanliness or fire risk is important.

Sixth: For operation over yard and branch line tracks and structures which are too light for road locomotives and where usually an out-of-date steam locomotive with attendant watchman, engine house facilities has to be maintained.

A number of slides was here presented; three of these show comparative costs of Porter 60-ton oil-electric locomotive and steam locomotives.

PORTER 60-TON OIL-ELECTRIC LOCOMOTIVE VERSUS 75-TON STEAM LOCOMOTIVE ROAD "A"

	Oil-Elec.	Steam
Total time locomotive in service	18′ 10″	14′ 50″
Total time locomotive working	13′ 15″	9′ 17″
Total time locomotive idle	..	4′ 11″
Total time locomotive idle with engine running	3′ 27″	....
Total time locomotive one engine running	9′ 05″	.....
Total time locomotive two engines running	4′ 10″	.....
Total time locomotive taking water		21″
Total time lunch and changing crews	1′ 28″	1′ 01″
Total locomotive moves	387	196
Total move with cars	207	149
Total move light locomotive	68	47
Total move testing yard scales	112	
Total number of cars moved	1152	643
Fuel Oil	67 Gal.	....
Coal		6 tons
Water		5500 Gal.
Lubricating Oil	3½ Qts.	....
Valve Oil		2 Qts.
Engine Oil		1 Pt.
Locomotive moves per hour	21.3	13.21
Cars moved per locomotive hour	63.4	43.3
Cost per hour	\$0.174	\$0.743
Cost per car moved	0.0027	0.017

Fuel oil figured at \$.04 per gallon and coal at \$1.70 per ton. Water at \$.14 per 1000 gallons. Wages not considered.

PORTER 60-TON OIL-ELECTRIC LOCOMOTIVE VERSUS 60-TON STEAM LOCOMOTIVE ROAD "B"

	Oil-Elec.	Steam
No. of shifts worked (normal 8 Hr.)	118	118
No. of hours worked	945	945
Mileage (6 M. P. H.)	5,675	5,675
Fuel Oil	3,894 Gal.	.....
Coal	.....	236 Tons
Water, lubricants, supplies, engine house expense	.243	.419
Fuel oil and coal cost per hour	.168	.675
Loco. repairs—cost per hour	.160	.901
Total operating expenses per hour	.571	2.00

Fuel oil figures at \$.033 per gallon and coal at \$2.13 per ton. Wages not included.

PORTER 60-TON OIL-ELECTRIC LOCOMOTIVE VERSUS 76 AND 115-TON STEAM LOCOMOTIVE ROAD "C"

	Oil-Elec.	Steam
Total hours in service	82	80
Total number of shifts light	429	522
Total number of shifts with cars	1265	1354
Total number of cars shifted	5698	5817

Average number of cars per shift	4.5	4.9
Total distance travelled—miles	270	274
Total amount of fuel oil	405 Gal.	
Total amount of coal		27.75 Tons
*Total amount of lubricating oil	10 Gal.	3.75 Gal.
Total amount of water		49,158 Gal.
Average cost of fuel, lubrication, water, per mile	$0.086	$0.2198
Average cost of fuel, lubrication, water per hour	0.283	0.753
Average cost of fuel, lubrication, water, per car shifted	0.00468	0.01035

*Lubricating oil consumption higher than normal for oil-electric during this test, due to excess oil under cylinder covers, later overcome by control of oil feed.

Fuel oil costs based on $.04½ per gallon, coal at $1.90 per ton on tank; water at $.12 per 1000 gallons. Wages not considered.

PRESIDENT: This is very interesting. A little locomotive with all the weight on the drivers. That is the reason they can get so much tractive power at low speeds. If you can do more with the same weight, do it, of course.

I am sure some of you may have some questions to ask. There is a field for these oil and gas-electric locomotives. Are there any questions?

MR. C. O. DAMBACH: I would like to ask Mr. Kromer a couple of questions. (1) If I heard the paper correctly Mr. Kromer figured on only one fireman. Since the law requires two firemen in certain states there of course would not be any saving effected in that respect when legal requirements necessitated two men on an engine. Further, I understand Diesel Electric is recommended for yard work and if this is the case my experience has been that if there is any place that two men are needed on an engine it is in the yard in order that the fireman may take signals on his side of the engine.

(2) I could not see the figures very well but as I am very much interested in costs I would like to ask Mr. Kromer whether they include interest and depreciation. We realize that electric locomotives cost a lot more than steam locomotives and in order to get comparative costs I would be glad to be advised as to the rate of depreciation charged on the oil-electric engine.

MR. KROMER: The life of an oil-electric locomotive is from 20 to 25 years.

MR. DAMBACH: Four to five per cent?

MR. KROMER: Yes, Sir.

MR. DAMBACH: About the same as a steam locomotive?

MR. KROMER: We figure about the same depreciation.

MR. DAMBACH: The electric machine depreciates faster than the steam locomotive.

MR. KROMER: We do not think so. Accurate figures for depreciation are not available as modern oil and gas-electric locomotives have not been in use long enough. The life of the electric equipment and the mechanical parts should not differ from those of straight electric locomotives for which 25 years is generally taken. The life of the oil engine can be figured as 10 years, that of the gasoline engine as five years, but this will depend largely on the service the locomotive has to perform.

The operating costs of the 60-ton oil-electric compared with steam locomotives which we showed on the slides were computed by the railroad on which the locomotive was used for demonstration. Each road computed the data in a different way and the ratio between the cost of fuel oil and coal also differs greatly, but the ratio of operating cost is about 1 to 3 in favor of the oil-electric in each case. Labor, depreciation, interest and maintenance have not been taken into consideration in these computations.

The Westinghouse Electric & Manufacturing Company has several oil-electric locomotives in use at their East Pittsburgh plant. I see Mr. Candee in the audience; perhaps he could give us some figures on depreciation.

MR. A. H. CANDEE: We prefer to refer to figures compiled by somebody else rather than ourselves. The figures we use are those compiled by the American Electric Railway Association, which each year secures all possible data on oil-electric locomotives in actual use. Next week they will issue another report which will show the actual costs on all the locomotives upon which they can get reliable figures.

As far as the costs go, I think Mr. Kromer has stated them fairly well. I have some actual figures, taken from an advance copy of this American Electric Railway Association report, on a railroad which operates 366 steam locomotives in switching service, averaging about 75 tons in weight. Cost for wages per hour, $1.65; fuel, .97; lubrication, .013; repairs, 1.43; engine house expense, .37; depression, .07, and fixed charges, .15.

As against that the average for oil-electric locomotives—remember the oil-electric locomotives are not operated in such numbers as the steam locomotives and therefore the costs are probably somewhat higher than if they were operated in larger fleets—the cost for wages if a single man is used will run about $0.90 to $0.92, but a two-man crew will run about the same as the steam locomotive. Fuel, in place of 0.97 will approximate 25 cents an hour. Lubrication is somewhat higher, due to the oil used by the engine in the crank case. We use $0.09 for that; repairs .76 in place of 1.43; engine house expense .13 in place of .37. (There is very little engine house expense connected with the oil-electric). For depreciation we have been using $0.28, and for other fixed charges $0.50. As a matter of fact the oil-electric locomotive first cost is about double that of the steam locomotive, so that the fixed charges should run about double those of the steam locomotive on the same basis. The total actual costs of the oil-electric will run around $2.13 and the steam $4.66.

The Westinghouse plant at East Pittsburgh is completely Dieselized. We use Diesel locomotives for all our yard work. We find those locomotives save us $3.00 an hour per locomotive as compared with steam.

PRESIDENT: Mr. Schenck, of the Westinghouse Electric, is here and we would like to hear a word from you.

MR. S. B. SCHENCK: The paper dealt largely with the oil-electric locomotives so I would like to say a word for the gas-electric. Many railroads use gas-electric rail cars in some of their services and save money thereby. There are obviously on every railroad places where a rail car does not fit and a steam locomotive does not fit but a gas-electric locomotive is well suited, particularly in mixed train service. There is a 50-ton locomotive being built for this particular service, by a railroad which has over 50 gas-electric rail cars in service and this road is convinced the locomotive will do them good work in outlying districts.

The gas-electric locomotive uses expensive fuel and more of it than the oil-electric, but in ordinary switching work where fuel oil is used at about three or four gallons per hour we can use in the neighborhood of five or six gallons of gasoline even though it costs about three times as much per gallon, and still break even on the over-all cost.

I mention these points because the same general type of loco-

motive is available for either gasoline or Diesel fuel using similar powered engines and electric equipment. An interesting sidelight on this type of locomotive also indicates that it may be used in one sense as a business-getter. I rode one of the gas-electric locomotives in trial service in Pittsburgh along the Allegheny River last summer. We were working at a building where there were two sets of railroad tracks, one on each side of the building with tracks going into the building and connecting the two sets. A steam locomotive could not go into the building but the gas-electric could and did do so. The crew remarked that such performance would permit the gas-electric locomotive to go through the building and get the cars on the other side. This would build up more traffic for one railroad but at the expense of the other, and indicates an interesting possibility. Another railroad which has not put a locomotive into service, gave strong consideration to the possibility of purchasing a gas-electric locomotive using it for part of a day then delivering it to the gates of an industrial plant and turning it over to the crew of the industrial yard to operate, thus saving the industrial plant a considerable sum over the hire for the larger steam locomotive and railroad crew. This indicates that the gas-electric locomotive not only will save money but can be used more effectively in many places than the average steam locomotive.

In connection with the gas-electric, there is a 90-ton gas-electric operating for two years past in railroad yard switching in the Middle West. It has been maintained at a cost of between 50 to 60 cents a locomotive hour, and while it is a 600 h.p. locomotive it uses only 80 to 100 gallons of gasoline per day. I think that speaks well for this type of motive power.

PRESIDENT: If any of you railroaders have any of these engines in use we would like to hear from you. I see Mr. J. B. Diven of the Pennsylvania Motive Power Department.

MR. J. B. DIVEN: I was not fortunate enough to hear the paper read, having been out of town and arrived at the meeting just in time to hear it finished. As to gas and oil-electric locomotives, I feel there is a place for them. We have some of these locomotives in our service, but not under my immediate jurisdiction so I am not in position to discuss them in connection with this paper.

PRESIDENT: Has anybody else any questions to ask? I

was very much interested in the operating costs as well as the over-all costs. It seems very good if you can operate it for less than one-half as much as the steam locomotive in switching service.

Mr. Flinn is here. I wonder if you would give us a word?

MR. R. H. FLINN: I haven't anything to say about this subject. I do not know a great deal about it. But from what I have seen and heard I have got to assume that there must be a place somewhere in the transportation picture for the oil-electric or the gas-electric locomotive.

Mr. Dambach brought up a question which occurred to me, which has possibly been fully answered. One of the principal reasons why more oil-electric locomotives are not used is because of the reluctance of the Boards of Directors to buy anything that we can get along without. That is the principal reason why there are not more of them in use.

PRESIDENT: Is there any further discussion of the paper?

MR. A. H. CANDEE: I had an opportunity of reading a preliminary copy of Mr. Kromer's paper so I have made a few notes for discussion.

One reason why the railroad men have not generally accepted the Diesel locomotive so far is because they have been somewhat skeptical of its operation. There are now enough Diesel locomotives in the country so that some reliable figures are available. You will probably see in the future more and more of these locomotives used when the Boards of Directors loosen the purse strings again. The economies are proved, but you cannot expect to use these locomotives indiscriminately and have them successful.

In regard to the curve Mr. Kromer showed on the sceren, you must not take those curves too literally. The steam locomotive seldom equals the curve shown on the screen, due to dirty boilers and fires and various other reasons. The oil-electric in general meets the curve that was shown with reasonable regularity. There is usually a margin in the engine power so that the performance can be met if the engine receives reasonable maintainance. The electric equipment itself never changes. Better adhesions are possible with the oil-electric locomotive due to the fact that rotating machines are used for driving the axles and the tractive effort is not subject to the pulsations that occur in the steam locomotive. In addition, the axles are individually driven. If one pair of wheels slips it does not necessarily affect the others.

Mr. Kromer brought out that the substitution of oil-electric units for steam is purely a matter of economics. As soon as the railroads accept this unit for use where it saves money at present prices, the increased manufacturing volume will probably result in lower costs and as prices drop these locomotives will save money in places that cannot show extreme savings at the present time.

As far as the question of a single engineman goes, as compared with two men, there may be state laws requiring two men on steam locomotives. I do not think those laws cover electric locomotives. The oil-electric unit is an electric locomotive, as decided by the courts in Ohio and other states; therefore it is entirely possible to use one man in place of two, provided the railroad agrees with their labor organizations on this point.

As far as control and visibility is concerned, locomotives are built with full control at each side so a man can stand at one side or the other and get visibility on each side of the train. If the crew crosses over he can cross over at the same time and get his signals. Locomotives are being operated in some places where the buildings require that the engineer step to the other side of the cab having full control of the locomotive at all times, and in that way the engine may be operated with one man, with a large saving.

Oil-electric locomotives are being built at the present time mostly for switching service. The engines developed at the present time are from 50 h.p. to 400 h.p. There are a few experimental engines at 800 h.p. but they are purely experimental. But by using two power units on a locomotive we can get as high as 800 h.p. in commercial locomotives. For freight service and passenger service it takes power and lots of it. Eventually these services will be operated by oil locomotives but large capacity engines are not now available. It is expensive to develop these, and it is slow work because it is necessary to step out into the unknown. The largest experimental locomotive in the world is 2660 h.p., built for the Canadian National. Mr. Brooks, of the Canadian National, gave you some figures on it two or three years ago.

Comparing gasoline engines with oil engines, I agree that there is a place for gasoline engined locomotives, but in general the cost of operation is the same for oil-electric locomotives as for gasoline, with the exception of the fuel cost. If the locomotive is in such service that the quantity of fuel used is small, the

gasoline engine has a place, but where the locomotive is used hard the possible reduced fuel expense justifying the use of the oil-electric.

PRESIDENT: Has any one else anything to add to the discussion? If not, we will hear the report of the Nominating Committee, if they are ready to report.

MR. E. EMERY: Mr. President, your Committee to nominate officers for the ensuing year wish to make the following report:

FOR PRESIDENT: J. E. Hughes, Superintendent, P. & L. E. R. R. Co.

FOR FIRST VICE PRESIDENT: F. I. Snyder, Vice President and General Manager, B. & L. E. R. R. Co.

FOR SECOND VICE PRESIDENT: C. O. Dambach, Superintendent, P. & W. Va. Ry. Co.

FOR SECRETARY: J. D. Conway.

FOR TREASURER: E. J. Searles.

EXECUTIVE COMMITTEE—(Ten to elect): Frank J. Lanahan, A. Stucki, Samuel Lynn, D. F. Crawford, F. G. Minnick, G. W. Wildin, E. J. Devans, W. S. McAbee, E. W. Smith, Louis E. Endsley.

SUBJECT COMMITTEE—(Two to elect): Two years, R. H. Flinn; three years, R. P. Forsberg.

RECEPTION COMMITTEE—(Five to elect): One year, H. W. Jones; three years, T. F. Sheridan, Harold F. Dunbar, T. E. Cannon and Karl Berg.

ENTERTAINMENT COMMITTEE—(One to elect): Three years, J. W. Hoover.

FINANCE COMMITTEE—(One to elect): Two years, J. S. Lanahan.

MEMBERSHIP COMMITTEE—(Four to elect): Three years, T. Fitzgerald, F. J. Nannah, A. M. Frauenheim and H. T. Cromwell.

PRESIDENT: You have heard the report of the Committee. Do I hear any other nominations?

ON MOTION the Report of the Committee is accepted and nominations are closed.

PRESIDENT: The election will be by letter ballot, as usual.

This being the last meeting over which I will officially preside, I want to say that I have enjoyed it very much. I have tried to be here at all the meetings. I missed one, unfortunately, because of my father's death. We have had good attendance and good discussions and I want to thank you all for helping in these meetings. I expect to continue to be present at the meetings and to be one of the men you will have to listen to, and I intend to make you hear what I have to say. Again I thank you for the honor of being your President for the past year and I will show my appreciation by the earnestness of my work for the club in the future.

MR. J. E. HUGHES: Mr. President, this has been a very interesting address, presented by Mr. Kromer, and I move a rising vote of thanks be extended him.

Motion being duly seconded was unanimously carried. There being no further business, on motion adjourned.

J. D. CONWAY, Secretary.

RESERVED

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

$1.00 Per Year 25¢ Per Copy

Vol. XXX. OCTOBER 22, 1931. No. 9.

ANNUAL MEETING—ELECTION OF OFFICERS
LIST OF MEMBERS

OFFICIAL PROCEEDINGS
OF

The Railway Club of Pittsburgh

Organized October 18, 1901

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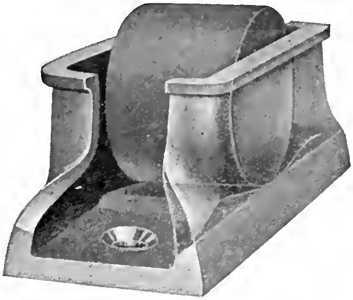

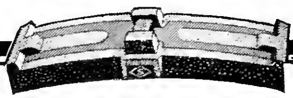

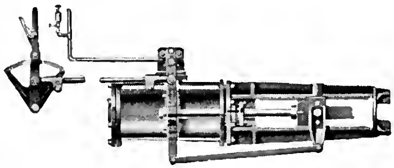

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OFFICIAL PROCEEDINGS

OF

The Railway Club of Pittsburgh

Organized October 18, 1901

Vol. XXX No. 9 — Pittsburgh, Pa., Oct. 22, 1931. — $1.00 Per Year 25c Per Copy

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

OCTOBER 22nd, 1931

The Annual Meeting was called to order at the Fort Pitt Hotel at 8 o'clock, P. M., with President Louis E. Endsley in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Adler, A. C.
Allen, Harvey
Allinger, N. J.
Altsman, W. H.
Ambrose, W. F.
Anger, C. E.
Anger, J. G.
Arnold, J. J.
Ashton, William A.
Babcock, F. H.
Bald, E. J.
Balzer, C. E.
Beeson, H. L.
Bell, D. H.
Berghane, A. L.
Bernoulli, W. H.
Bihler, L. C.
Bittner, George
Boate, H. S.
Bowery, Frank J.
Boylan, P. F
Braun, O. F.
Brinkhoff, W. H.
Brown, C. C.
Buffington, W. P.
Campbell, Harry V.
Campbell, James E.
Campbell, J. T.
Campbell, W. T.
Callahan, F. J.
Cannon, T. E.
Carlson, L. E.
Carr, T. W.
Carson, John
Cassiday, David A.
Clark, C. C.
Clements, Frank C.
Cherry, J. T.
Christy, F. X.
Conway, J. D.
Cotter, G. L.
Courtney, H.
Crenner, J. A.
Croke, Thomas F.
Cunningham, R. I.
Cunningham, W. P.
Dalzell, W. E.
Darrall, W. G.
Daugherty, W. A.
Davis, Charles S.
Davis, John W.
Dehne, George C.
Diven, J. B.
Doyle, T. E.
Dunbar, Harold F.
Durkin, James E.
Edwards, Clifton H.
Emery, E.
Emsheimer, Louis
En Dean, J. T.
Endsley, Prof. Louis E.
Erickson, L. S.
Falkner, A. J.
Farrington, Robert J.
Fendner, W. J.
Fenton, H. H.
Filson, Harry T.
Fink, P. J.
Fischer, G. E.
Fleckenstein, August
Flinn, R. H.
Forsberg, R. P.
Foster, F. L.
Fox, George W.
Frauenheim, A. M.

Frauenheim, P. H.
Freshwater, F. H.
Fritz, A. A.
Gaffney, Thomas H.
Gardner, George R.
Gatfield, Phillip
Glaser, J. P.
Glenn, J. H.
Goda, P. H.
Goff, J. P.
Goodman, O. F.
Hackett, C. M.
Hall, Charles B.
Haller, Nelson M.
Hamilton, W. H.
Hansen, W. C.
Harper, J. T.
Hastings, W. S.
Herrold, A. E.
Hervey, R. S.
Hiester, E. G.
Hilstrom, A. V.
Holmes, E. H.
Honsberger, G. W.
Hood, C. E.
Hood, J. M.
Huber, H. G.
Hughes, J. E.
Irwin, R. D.
Jones, H. W.
Kamerer, R. W.
Kaup, Earle W.
Kaup, H. E.
Kelly, John P.
Kelly, L. J.
Kempton, J. W.
Kerr, C. R.
Keys, A. H.
Kinney, T. F.
Kirk, W. B.
Kohute, H. G.
Kromer, William F.
Kroske, J. F.
Kummer, Joseph H.
Lanahan, Frank J.
Landis, William C.
Lang, W. C.
Laughner, C. L.
Laurent, Joseph A.
Lawson, A. F.
Leban, J. L.
Lees, Thomas
Leet, C. S.
Lehr, H. W.
Linsenbigler, A. J.
Lobez, P. L.
Loeffler, George O.
Long, R. M.
Longdon, C. V.
Lynn, Samuel
Maliphant, C. W.
Manson, A. J.
Marquis, George E.
Masterman, T. W.
Matthews, R. J.
Mauck, E. A.
Mayer, L. I.
Merscher, John
Millar, C. W.
Miller, J.
Miller, W. H.
Misner, G. W.
Mitchell, F. K.
Mitchell, W. S.
Moir, W. B.
Moody, M. R.
Moore, D. O.
Morgan, Homer C.
McCully, D. L.
McGeorge, D. W.
McIntyre, R. C.
McKenzie, Edward F.
McKinley, A. J.
McKinstry, C. H.
McMillan, A. P.
McNamee, W.
McPherson, A. R.
Nagel, James
Nannah, F. J.
Nelson, W. M.
Nieman, Harry L.
Noble, Jesse A.
O'Leary, Jeremiah J.
Osborne, W. J.
Palmer, E. A.
Passmore, H. E.
Peiffer, Charles E.
Peterson, W. M.
Pickard, S. B.
Pollock, J. H.

Posteraro, S. F.
Pringle, P. V.
Queer, Thomas H.
Rabold, W. E.
Rauschart, E. A.
Reeve, George
Redding, P. E.
Redding, R. D.
Richardson, H. R.
Rizzo, C. M.
Robinson, R. L.
Roth, Philip J.
Ryan, D. M.
Saltic, Thomas
Sample, W. E.
Sattley, E. C.
Schaffer, W. E.
Schmitt, Raymond F.
Searles, E. J.
Seibert, W. L.
Seiss, Wm. C.
Seroky, Ed. A.
Severn, A. B.
Sheets, H. E.
Shellenbarger, H. M.
Sheridan, Thomas F.
Simons, Philip
Smith, J. Frank
Smith, R. W.
Smith, Robert B.
Snyder, F. I.
Spinning, Charles F.
Stamets, William K.
Stephen, James
Stevens, L. V.
Stevens, R. R.
Stillwagon, C. K.
Stucki, A.
Sutherland, Lloyd
Thomas, Harold N.
Thomas, Theodore
Tomasic, J. D.
Tomasic, Nicholas, Jr.
Tovey, George F.
Trautman, Harvey J.
Tyrie, R. M.
Uhar, John J.
Warner, R. H.
Warrensford, Fred S.
Waterman, E. H.
Weaver, W. Frank
Welch, E. M.
Weston, A. P.
Wheatley, William
White, J. C.
Wikander, Oscar R.
Wildin, G. W.
Wilharm, John H.
Winslow, Sidney H.
Wittman, E. A.
Woodward, R.
Wyke, J. W.
Yarnall, Jesse
Yeager, George
Young, F. C.
Zammikiel, John

VISITORS

Altman, C. F.
Alston, Arch
Armstrong, Richard
Atkins, H. E.
Bald, H. H.
Beam, W. H.
Becker, Walter F.
Becker, Walter H.
Bell, R. P.
Benn, W. A.
Berbach, Leo J.
Berger, John S.
Bohanan, T. M.
Boyer, S. H.
Brandau, W. O.
Braun, J. G.
Brown, R. J.
Bryan, Thomas
Burgess, T. S.
Burkhard, John J.
Burriss, H. E.
Burriss, Walter C.
Carliner, T. E.
Carruthers, G. R.
Chalmers, J. W.
Chambers, Charles
Cherry, W. W.
Christy, George J.

Clancy, J. A.
Colclaser, L. A.
Collins, James
Cook, S. J.
Craig, James A.
Cravener, James
Cunningham, Howard L.
Davies, Benjamin S.
Deramo, T.
Devenzio, Vincent
DeVilbiss, E.
Douglas, William C.
Dunn, C. A.
Dunn, Robert
Dunn, R. G.
Dunsmoor, F. L.
Eichorn, T. F.
Ercole, V. E.
Faison, L. H.
Farrington, Arthur R.
Ferguson, D. S.
Fleckenstein, John A.
Forbes, W. R.
Forger, F. G.
Fralic, C. F.
Friend, E. F.
Garrity, T. M.
Gayetty, Charles H.
Germak, George
Germerodt, Howard E.
Gilmore, Glenn T.
Glaister, T. W.
Goebel, Michael
Goldstrom, G. E.
Gollmer, H. C.
Goodwin, Arthur E.
Gray, R. H.
Griffin, T. G.
Grimm, W. B.
Guard, Thomas
Haggerty, J. J.
Hall, George A.
Hamilton, J. S.
Harper, Kenneth
Harrison, J. A.
Hayes, Sidney J.
Heer, Walter
Heimsberg, A. H.
Hemma, Charles H.
Herbst, F. A.
Herley, J E.
Hershey, W. G.
Hogle, J. A., Jr.
Houck, C. M.
Hubbard, R.
Jados, W. S.
Janis, G. L.
Jenkins, Lenwood
John, William
Rowland, James
Keist, W. J.
Kindle, Thomas C.
Kirchner, H. B.
Knapp, Ray F.
Koehler, Paul A.
Kozusko, Andrew
Krapf, H. C.
Krance, F. E.
Ladd, Tallman
Latshaw, T. R.
Lesko, Michael
Lewis, N. F.
Lewis, S. B.
Lindberg, W.
Lyons, J. C.
Macoubray, R. J.
Manley, W. J., Jr.
Mannke, Ellwood R.
Mantle, E. H.
Marsh, E. A.
Marx, Frank J.
Metzger, Christian L.
Mikesell, Francis
Miller, E. B.
Miller, Ted
Mitchell, Paul C.
Moletares, A. J.
Moore, David M.
Morse, F. L.
Mullooly, C. J.
Murray, L. J.
Mycoff, George H.
McAlister, James
McCay, W. J.
McCreighton, P.
McQuade, P. J.
Nagel, James, Jr.
Nicholas, H. D.
O'Hagan, J. E.
O'Neil, J. T.

Osterriedee, A. J.
Parks, H. E.
Peat, James
Penn, C. D.
Peterson, D.
Peterson, F. B.
Peterson, Harry
Petrie, William J.
Pickels, H. D.
Pomrenke, F. G.
Porter, Robert
Pugh, A. J.
Reed, C. R.
Reed, C. Richard
Reehl, H. D.
Rehlin, T. G.
Rehlin, Walter C.
Rickenbach, George S.
Riley, Dr. W. J.
Robertson, M. R.
Ross, F. J.
Ryce, Edwin S.
Sable, A. C.
Sarosdy, L. T.
Schadt, A. D.
Schmitt, John F.
Schrenker, Robert D.
Schrontz, S. B.
Scott, L. M.
Smith, Sion B.
Smith, W. H.
Snyder, H. C.
Stearns, William G.
Stewart, W. D.
Strehlan, Edward H.
Sullivan, Arthur
Sullivan, Clarence F.
Tarr, George H.
Thrall, O. B.
Tekula, P.
Tuski, John
Vogel, E. E.
Vollmer, Walter K.
Ward, N. H.
Weeks, Charles D.
Weitzel, C. E.
Welter, William P.
Wheatley, Albert R.
Wickline, Walter I.
Wilbraham, E. L.
Winkler, Arthur H.
Wresen, E. S.
Zimmerman, C. R.
Zimmerman, Fred

PRESIDENT: We will dispose with the call of the roll as you have all signed registration cards. Also with the reading of the minutes, as the printed Proceedings are already in your hands.

I will ask the Secretary to read the list of applications for membership.

SECRETARY: We have the folliwing applications for membership:

Aaron, Paul S., Fort Pitt Malleable Iron Company, 304 Grove Street, McKees Rocks, Pa. Recommended by Joseph H. Kummer.

Ament, F. Chalmer, Engine and Train Service Inspector, Pennsylvania Railroad, Pittsburgh Division, 6932 Standish Street, Pittsburgh (6), Pa. Recommended by Edward F. McKenzie.

Armstrong, Richard, Metallurgist, Union Steel Casting Company,

62nd and Butler Streets, Pittsburgh, Pa. Recommended by J. F. Kroske.

Connelly, B. M., Sawhill Manufacturing Company, 418 Oliver Building, Pittsburgh, Pa. Recommended by E. H. Holmes.

Cunningham, J. Donald, Sales Engineer, Southern Wheel Company, 150 Grace Avenue, Lakewood, Ohio. Recommended by W. C. Lang.

Gardner, James E., Special Representative, Schaeffer Equipment Company, Koppers Building, Pittsburgh, Pa. Recommended by E. J. Searles.

Henderson, George L., Engineer, P. & L. E. R. R. Co., 228 Sheridan Avenue, New Castle, Pa. Recommended by A. J. McKinley.

Kruse, J. F. W., Superintendent, Woodings-Verona Tool Works, 528 Washington Avenue, Oakmont, Pa. Recommended by H. E. Passmore.

Mercer, B. F., Vice President and General Manager, Union Steel Casting Company, 62nd and Butler Streets, Pittsburgh, Pa. Recommended by J. F. Kroske.

McKay, N. H., Manager, U. S. Chromium Corporation, 1100 Pitt Street, Wilkinsburg, Pa. Recommended by Norman Allderdice.

Sawhill, Don M., Sawhill Manufacturing Company, 418 Oliver Building, Pittsburgh, Pa. Recommended by E. H. Holmes.

PRESIDENT: In accordance with the provisions of our By-laws these applications will be referred to the Executive Committee and upon approval by them the gentlemen will become members without further action than the payment of the current year's dues.

SECRETARY: Since our last meeting I have received information of the death of one of our members, Mr. A. Jungbluth, Engineer, 6616 Jackson Street, Pittsburgh, who passed away on October 20, 1931.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

We will now hear the Annual Report of the Secretary.

SECRETARY'S REPORT

Pittsburgh, Pa., October 22, 1931.

To the Officers and Members of
The Railway Club of Pittsburgh,

Gentlemen:

The following is a summary of membership and financial statement for the fiscal year ended October 22, 1931:

Membership reported last year	1,279	
Reinstated	2	
Received into membership during year	79	
		1,360
Suspended non-payment dues	201	
Resigned	86	
Loss of Address	9	
Deaths reported during year	10	
		306
Present membership		1,054

Of the above membership four are honorary. They are: D. C. Buell, Samuel O. Dunn, Julian Kennedy and John A. Penton.

DECEASED MEMBERS

W. S. Bartholomew	January 6, 1931
C. H. Forrest	July 26, 1930
W. F. Greene	July 6, 1931
William H. Jacobs	April 14, 1931
A. Jungbluth	October 20, 1931
J. N. O'Malley	May 21, 1930
Benjamin H. Rush	December 28, 1930
J. J. Turner	May 29, 1928
W. R. Wilson	April 29, 1931
S. C. Wolfersberger	October 10, 1929

FINANCIAL

Receipts

In hands of Treasurer at close of last year	$7,381.36
From advertisements	1,400.54
From dues	2,898.00
From sale of Proceedings	41.85

Smoker tickets and dinner, October 23, 1930	670.50	
Miscellaneous sources	1.50	
From interest, Liberty Bonds and bank balance	173.45	
		$12,567.20

Disbursements

Printing Proceedings, Notices, Mailing, etc.	$2,356.00	
Hall, Luncheon, Cigars, etc.	831.00	
Reporting Proceedings	180.00	
Salaries and Advertising expenses	1,140.05	
Premium on Bonds, Treasurer and Secretary	17.50	
Dinner, Entertainment, Smoker, etc., October 23, 1930	874.25	
Moving Pictures	65.00	
Messenger service, affidavits, etc.	19.00	
		$ 5,482.80
Net Balance		$ 7,084.40

Balance is made up of $5,084.40 cash and two United States Liberty Bonds $1,000.00 each.

J. D. CONWAY, Secretary.

APPROVED:

EXECUTIVE COMMITTEE,
FRANK J. LANAHAN, Chairman.

PRESIDENT: You have heard the Annual report of your Secretary. What is your wish as to its disposition?

ON MOTION the Report is accepted and ordered filed.

PRESIDENT: We will now hear the Annual Report of the Treasurer.

TREASURER'S REPORT

To the Officers and Members of
The Railway Club of Pittsburgh,

Gentlemen:

I herewith submit my report for the year ended, October 22, 1931:

ON HAND AND RECEIPTS

Cash on hand October 23, 1930	$ 5,381.36
Moneys received from J. D. Conway, Secretary from October 23, 1930 to October 22, 1931	5,012.39

Interest on Liberty Bonds	85.00
Interest on bank balance	88.45
	$10,567.20

DISBURSEMENTS

Paid on Vouchers Nos. 715 to 742 inclusive	5,482.80
Balance	$ 5,084.40

RESOURCES

Two U. S. Liberty Bonds, $1,000.00 each	$ 2,000.00
Cash Balance on hand October 22, 1931	5,084.40
Total	$ 7,084.40

E. J. SEARLES,
Treasurer.

APPROVED:

EXECUTIVE COMMITTEE,
FRANK J. LANAHAN, Chairman.

ON MOTION the Report of the Treasurer is accepted and referred to the Auditing Committee.

We have audited the accounts of the Secretary and Treasurer, and find them correct as reported.

LLOYD SUTHERLAND, Chairman,
JOHN B. WRIGHT,
Members of Finance Committee.

PRESIDENT: We will now have the report of the Tellers of the Election of officers for the ensuing year.

SECRETARY: The result of the election is as follows: Total number of votes cast 226, and the vote in each case practically unanimous for the gentlemen named:

PRESIDENT—J. E. Hughes, Superintendent, P. & L. E. R. R. Company.

FIRST VICE-PRESIDENT—F. I. Snyder, Vice-President & General Manager, B. & L. E. R. R. Co.

SECOND VICE-PRESIDENT—C. O. Dambach, Superintendent, P. & W. Va. Ry. Co.

TREASURER—E. J. Searles, Manager, Schaefer Equipment Co.

SECRETARY—J. D. Conway.

EXECUTIVE COMMITTEE—Frank J. Lanahan, Chairman; A. Stucki, Samuel Lynn, D. F. Crawford, F. G. Minnick, G. W. Wildin, E. J. Devans, W. S. McAbee, E. W. Smith, Louis E. Endsley.

SUBJECT COMMITTEE*—R. H. Flinn, Chairman, 2 years; S. G. Down, 1 year; R. P. Forsberg, 3 years.

RECEPTION COMMITTEE*—Col. H. C. Nutt, Chairman; H. W. Jones, 1 year; F. H. Freshwater, W. P. Buffington, 2 years; T. F. Sheridan, Harold F. Dunbar, T. E. Cannon, Karl Berg, 3 years.

ENTERTAINMENT COMMITTEE*—A. B. Severn, Chairman, Joseph H. Kummer, 2 years; J. W. Hoover, 3 years.

FINANCE COMMITTEE*—Lloyd Sutherland, Chairman, 1 year; Charles Orchard, John B. Wright, Harry W. Lehr, J. S. Lanahan, 2 years.

MEMBERSHIP COMMITTEE*—A. F. Coulter, Chairman, 2 years; E. Emery, R. M. Long, Donald O. Moore, 1 year; F. L. Dobson, J. L. O'Toole, 2 years; T. Fitzgerald, F. J. Nannah, A. M. Frauenheim, H. T. Cromwell, 3 years.

PRESIDENT: I think at this time, before retiring from the chair, I will call upon the officers elect that you may know them and hear them. We would like first of all to hear from the President elect, Mr. J. E. Hughes.

MR. J. E. HUGHES: Mr. President and fellow members of the Railway Club, I want to offer my congratulations to the retiring President on the very successful year he has had as President of this Club. I appreciate very highly the honor you have conferred upon me in electing me as the President of your Club

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*In addition to newly elected committee members, the above list also gives names of those previously elected whose terms of office have not yet expired.

for the coming year. The only thing I can say is that I will earnestly endeavor to preside in a fair and impartial manner, and maintain the splendid record left by my predecessor. This with the help of you members. I thank you.

PRESIDENT: We will next hear from Mr. Snyder, First Vice-President elect.

MR. F. I. SNYDER: Mr. President and Members of the Railway Club of Pittsburgh:—I wish to thank you for the honor of the office to which I have been elected. I would like to say, too, that I do not have any apprehension as to this job. Knowing the ability and the capacity of our incoming President, I do not think there will be anything for me to do at all. I thank you.

PRESIDENT: We will now have a few words from our Second Vice-President, Mr. Dambach.

MR. C. O. DAMBACH: Mr. President and fellow members, I want to thank you for the honor you have bestowed upon me, and if I have the same co-operation you have given my predecessors I think possibly I will get by.

PRESIDENT: I think we ought to hear from Mr. Searles, our Treasurer.

MR. E. J. SEARLES: Gentlemen, I thank you for the honor of re-election. I am no speech maker, and I will leave that to others.

PRESIDENT: You do not hear from your Secretary very often, and I think you ought to have a word from Mr. Conway.

MR. J. D. CONWAY: Gentlemen, I had thought, when you welcomed the announcement of my election with such generous applause, that I would say something, but I have been heard so much upon all occasions during the last thirty years of the Club that you will certainly be glad if I do not get up and say anything. The duties of the office require me to go through the routine at each meeting, and that ought to be satisfactory, as long as I can show that the treasury has not been altogether strapped.

I do not wish to take up your time this evening with anything I might have to say, except to express my appreciation of the good will that still retains me in office. I sometimes wonder why I do not get discharged, or laid off temporarily, or suspended

for thirty days, or something like that. Seriously, however, I do very greatly appreciate the very generous reception you have given me, and I trust the work of the Secretary's office during the coming year will measure up to your every expectation.

PRESIDENT: Mr. Brown, Chairman of the Entertainment Committee, could not be here tonight, and Mr. Conway has kindly agreed to take charge of the entertainment program. Thanking you all most sincerely for the assistance you gave me during the year I have been your president, to which I owe whatever of success has attended my administration, I will now turn over the meeting to Mr. Conway.

MR. CONWAY: You will notice the way the Professor has of getting out of a job. He is pretty smooth at that. But I think we should not let him get off so easily. And I am going to put a task on a member of the Club to say something that may be pleasing to the Professor before he gets out of reach. I wonder if Mr. Lanahan will not act as pinch hitter.

MR. FRANK J. LANAHAN: Very much do I dislike to preface my remarks with an apology, but a bad cold makes this necessary. You all know that Mr. Conway is no respector of persons, nor does he have much consideration for the physical condition of a member when he desires anything done.

The immortal Shakespeare has said that, "All the world's a stage, and all the men and women merely players. They have their entry and their exit, and each in his time play's many parts." I know of no closer analogy to that expression of the immortal bard than the Railway Club of Pittsburgh. The stage is the forum where we all meet in a group to discuss topics of interest to each and everyone of us. The rostrum here is reserved for the dignitaries, they who preside over the destines of the Club, and those other learned gentlemen who every thirty days are invited to deliver to us words of wisdom to our great delight and instruction. Then there comes a time in the march of events when those who have entered the organization and by their attendance at the meetings and their participation in the affairs of the Club have proved their worth, are recognized by appointment on committees. Good work there brings a further measure of recognition of that service and they become Chairmen. The approval that has been given here tonight in the way of applause as the names of the various chairmen and officers were

read out, testified the satisfaction of the membership at large of those who have been designated for the next twelve months to lead the destinies of the Club. In time, when by service these members have been shown to be of proper calibre, they are selected for officers, first as Second Vice President, next as First Vice President and then receiving the crown of glory as President. For no greater honor can be given a man than to be recognized by his fellowmen as fit to head the organization as its chief executive to carry on its useful purposes.

Tonight you have given that honor to a very worthy man. For the next twelve months he will occupy a very dignified position and handle the gavel in the direction of the affairs of the Club, but with his inauguration, the curtain rings down on the official career of his predecessor, the gentleman who has occupied the spotlight for the past twelve months. This transition is inevitable; it is the eternal fitness of things that produces evolution in the official family, the development of new officers, and the infusion of fresh blood. All we can hope is that those who will preside over the high destinies of the future will do it with the same distinction and the success that was accorded their predecessors. The only honor to be extended to an ex-President is the affiliation with the Executive Committee, the supposition being that they having demonstrated a deep interest in the work of the Club and with a knowledge of what was best for it in the past, will be able to better exercise wisdom in shaping its future policies in maintaining the high standard that has characterized the organization in the years that have gone by.

But, Mr. President, for you are *still* Mr. President, it is a time honored custom of this Club to extend to the retiring executive, some visible evidence of the appreciation we have for duties well done. The membership at large feel that they would like to have some token from them to you that in the days to come you may look at it with pleasure, remembering the service you have rendered so willingly to the Club, and be reminded of the warm friendships you have formed through that service. The committee representing all those you see here tonight as well as those members who were unable to be present, have procured a token in the way of an Oriental rug, and I feel sure that when you take it home to Mrs. Endsley and her eyes fall on the artistic design and the beautiful texture, she will be glad indeed that you have friends of this character, and that she has a husband whose service has

earned for her this attractive household adornment that will be a joy for years to come. On behalf of the gentlemen here assembled, members of the Railway Club of Pittsburgh, do I say to you that it is with a feeling of unstinted admiration for the way in which you have handled the affairs of the Club, the warm regard for you personally, that we present to you tonight this evidence of our appreciation, affection and esteem.

PRESIDENT: I shall remember this evening many evenings through many years. I thank you.

A program of entertainment was then presented by Miss Maude Ingersoll of the Maude Ingersoll Productions, made up of a ladies' Pirate Orchestra, four Maude Ingersoll's Dancing Debbies, Elmer Maier, character actor, and Ruth Malcom, soprano vocalist.

In addition to the above, Mr. R. C. Reagan, Tenor Soloist, accompanied by Miss Grace Mitchell.

Smoker kits distributed to all present. At the conclusion of the meeting a very nice buffet luncheon was served.

J. D. CONWAY, Secretary.

CONSTITUTION

ARTICLE I

The name of this organization shall be "THE RAILWAY CLUB OF PITTSBURGH."

ARTICLE II

OBJECTS

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III

MEMBERSHIP

SECTION 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

SEC. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings, and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV

OFFICERS

The officers of this Club shall consist of a President, First Vice President, Second Vice President, Secretary, Treasurer, Finance Committee consisting of five or more members, Membership Committee consisting of seven or more members, Entertainment Committee consisting of three members, Reception Committee consisting of six or more members, Subject Committee consisting of three or more members, and an Elective Executive Committee of three or more members. The officers named shall serve a term of one year from date of their election, with the exception of the Finance, Membership, Entertainment, Reception and Subject Committees; the term of office of these committees shall be specified at the time of the Annual Election, but the term of office of the members of such committees shall not exceed three years.

ARTICLE V

DUTIES OF OFFICERS

SECTION 1. The President shall preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer; also serve as a member of the Executive Committee.

SEC. 2. The First Vice President, in the absence of the President, will perform all the duties of that officer; the Second Vice President, in the absence of the President and First Vice President, will perform the duties of the presiding officer. The First and Second Vice President shall also serve as members of the Executive Board.

SEC. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw checques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club Proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

SEC. 4. The Treasurer shall receipt for all moneys received from the Secretary, and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by checque signed by the Secretary and Treasurer.

SEC. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

SEC. 6. The Finance Committee will have general supervision over the finances of the Club, and perform such duties as may be assigned them by the President or First and Second Vice Presidents.

SEC. 7. The Membership Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents and such other duties as may be proper for such a committee.

SEC. 8. The Entertainment Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents, and such other duties as may be proper for such a committee.

ARTICLE VI

ELECTION OF OFFICERS

SECTION 1. The officers shall be elected at the regular annual meeting as follows, except as otherwise provided for:

SEC. 2. Printed forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

SEC. 3. The elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

SEC. 4. The President will announce the result of the ballot and declare the election.

SEC. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot.

ARTICLE VII

AMENDMENTS

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

BY-LAWS

ARTICLE I

MEETINGS

SECTION 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Thursday of each month, except June, July and August, at 8 o'clock P. M.

SEC. 2. The annual meeting shall be held on the fourth Thursday of October each year.

SEC. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

ARTICLE II

QUORUM

At any regular or special meeting nine members shall constitute a quorum.

ARTICLE III

DUES

SECTION 1. The annual dues of members shall be Two Dollars, payable in advance on or before the fourth Thursday of September each year.

SEC. 2. The annual subscription to the printed Proceedings of the Club shall be at the published price of One Dollar. Each member of the Club shall pay for both dues and subscription. Dues and subscription paid by members proposed at the meetings in September or October shall be credited for the following fiscal year.

SEC. 3. At the annual meeting members whose dues and subscription are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

SEC. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

ARTICLE IV

ORDER OF BUSINESS

1—Roll call.
2—Reading of the minutes.
3—Announcements of new members.
4—Reports of Committees.
5—Communications, notices, etc.
6—Unfinished business.
7—New business.
8—Recess.
9—Discussion of subjects presented at previous meeting.
10—Appointment of committees.
11—Election of officers.
12—Announcements.
13—Financial reports or statements.
14—Adjournment.

ARTICLE V

SUBJECTS—PUBLICATIONS

SECTION 1. The Subject Committee will provide the papers or matter for discussion at each regular meeting.

SEC. 2. The Proceedings or such portion as the Executive Committee may approve shall be published (standard size, 6x9 inches) and mailed to the members of the Club or other similar clubs with which exchange is made.

ARTICLE VI

The stenographic report of the meetings will be confined to resolutions, motions and discussions of papers unless otherwise directed by the presiding officer.

ARTICLE VII

AMENDMENTS

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

In Memoriam

A. JUNGBLUTH,

Died, October 20, 1931.

MEMBERS

Aaron, Paul S.,
Fort Pitt Mall. Iron Co.,
304 Grove St.,
McKees Rocks, Pa

Abbott, J. A.,
Trainmaster,
Western Maryland Ry.,
227 Saratoga St.,
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Abraham, Walter S.,
Asst. Foreman,
Westinghouse Air Brake Company,
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E. McKeesport, Pa.

Adams, Walter A.,
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P. & L. E. R. R.,
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Adler, Abe C.,
Clerk,
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Ainsworth, J. H.,
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Eng. & Train Service Insp'r ,
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Anger, John G.,
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W. P., McKees Rocks, Pa.

Blumling, Wm. G.,
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P. R. R., B. & O.,
Rdg. and W. M.,
Martinsburg, W. Va

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Brennan, T. F.,
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Brewer, H. W.,
Supt. of Shops,
B. R. & P. Ry.,
Du Bois, Pa.

Brinkhoff, W. H.,
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Supt., P. & L. E. R. R.,
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Brown, J. Alexander,
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Brown, John T., Jr.,
Supt., Federated Metal Corp.,
6667 Woodwell St.,
Pittsburgh, Pa.

Browne, Bard,
Asst. to Vice President,
The Superheater Co.,
60 East 42nd St.,
New York, N. Y.

Bruce, S. S.,
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The Koppers Co.,
Koppers Bldg.,
Pittsburgh, Pa.

Buckbee, W. A.,
The Superheater Co.,
Nyack, N. Y.

Buckwalter, T. V.,
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

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State of Pennsylvania }
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Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

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Sworn to and subscribed before me this 30th day of September, 1931.

(Seal) AGNES B. SHAW, Notary Public.
(My commission expires March 9, 1935.)

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